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Aleyrodidae: Aleurodicinae) from the Americas and Vietnam

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## Five new species of *Bakerius* Bondar (Hemiptera: Aleyrodidae: Aleurodicinae) from the Americas and Vietnam

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**Abstract.** Five new species of *Bakerius* Bondar (Hemiptera: Aleyrodidae: Aleurodicinae) are described and illustrated from the Americas and Vietnam based on the adult, nymph, and pupal stages: *Bakerius asiaticus*, *Bakerius colombianus*, *Bakerius hondurensis*, *Bakerius leei* and *Bakerius peruvianus*. The following six species: *Bakerius attenuatus* Bondar 1923, *Bakerius calmoni* Bondar 1928, *Bakerius marmoratus* (Hempel 1923), *Bakerius phrygilanthi* Bondar 1923, *Bakerius sanguineus* Bondar 1928, and *Bakerius sublatus* Bondar 1928 are re-described. An identification key to the New World genera of the subfamily Aleurodicinae, and a key to the adults and the puparia of *Bakerius* species are provided.

**Key words.** Asia, Brazil, quarantine, taxonomic keys, whiteflies.

**Resumen.** Se describen e ilustran cinco especies nuevas del género *Bakerius* Bondar (Hemiptera: Aleyrodidae: Aleurodicinae) en base a los adultos, ninfas y estadios pupales provenientes de las Americas y Vietnam: *Bakerius asiaticus*, *Bakerius colombianus*, *Bakerius hondurensis*, *Bakerius leei* y *Bakerius peruvianus*. Se re-describen las especies *Bakerius attenuatus* Bondar 1923, *Bakerius calmoni* Bondar 1928, *Bakerius marmoratus* (Hempel 1923), *Bakerius phrygilanthi* Bondar 1923, *Bakerius sanguineus* Bondar 1928, y *Bakerius sublatus* Bondar 1928. Se provee una clave puparia de los géneros del Nuevo Mundo de la subfamilia Aleurodicinae, y una clave de los adultos y puparias del género *Bakerius*.

**Palabras clave.** Asia, Brazil, claves taxonómicas, cuarentena, moscas blancas.

### Introduction

The family Aleyrodidae (Hemiptera: Sternorrhyncha) consists of one fossil subfamily, the Bernaeinae (Shcherbakov 2000) and three extant subfamilies: Aleurodicinae, Aleyrodinae, and Udamosellinae (Martin 2007). The Udamosellinae are composed of one genus containing two South American species from Ecuador. Morphologically, the Aleurodicinae and Udamosellinae are very similar, and the latter may prove to be a junior synonym of the former (Martin 2007).

The Aleurodicinae and the Aleyrodinae can be easily separated in both the adult and immature stages (instars). Historically, the 4th stage (puparium) has been used to identify species because the puparium is considered to have many more diagnostic structures than the adult and prepupal immature stages. The puparium, with few exceptions, can easily be identified to subfamily by the

presence of compound pores in most aleurodicine genera which are absent in all aleyrodine genera, the number of pairs of subapical setae present on the lingula (Aleurodicinae usually with two pairs and the Aleyrodinae with one pair), and the presence of an apical terminal claw (Aleurodicinae) versus an adhesive pad (Aleyrodinae) on the tarsus. Adult whiteflies can be readily identified to subfamily based on the wing venation, antennal segments, and ventral abdominal wax plates. Adult males and females of all the Aleurodicinae, except for the genus *Paraleyrodes* Quaintance (Aleurodicinae), have the R1 vein of the forewing forked. The genus *Paraleyrodes* and the Aleyrodinae has the R1 vein of the fore wing simple (not forked) as in all Aleyrodinae genera except *Aleurochiton*.

The genus *Bakerius* Bondar 1923 (Hemiptera: Aleyrodidae: Aleurodicinae) is a Neotropical genus currently comprised of 9 species, all described from Brazil. Enderlein (1909) described *Aleurodicus conspurcatus*, the earliest described species currently placed in the genus, from specimens Luderwaldt had collected in Santa Catharina, Brazil. Bondar described the genus *Bakerius* based on adult and pupal specimens of the type species, *Bakerius phrygilanthi*, in addition to *Bakerius attenuatus* (Bondar 1923), *Bakerius calmoni*, *Bakerius sanguineus* and *Bakerius sublatus* (Bondar 1928). Hempel (1922) described *Aleurodicus marmoratus*, which Martin (2004) transferred to the genus *Bakerius*. Hempel (1938) described *Bakerius glandulosus*. No comprehensive key to the puparia of *Bakerius* species exists. Penny and Arias (1980) described the adult stages of *Bakerius amazonicus* and *Bakerius maculatus* providing a key to the adults of all 9 species known at that time. The United States National Museum (USNM) is the depository for four of the nine described species of *Bakerius* and the undescribed species collected or intercepted in quarantine from Brazil, Colombia, Ecuador, Honduras, Peru, and Vietnam (origin uncertain, intercepted in quarantine at JFK International airport in baggage). Five new species of *Bakerius*: *B. asiaticus*, *B. colombianus*, *B. hondurensis*, *B. leei* and *B. peruvianus* are described and illustrated based on characteristics of their puparia. An identification key to the New World genera of the subfamily Aleurodicinae, and a key to the adults and the puparia of the genus *Bakerius* are provided.

## Materials and Methods

Most adults, puparia and other stage nymphs were received slide mounted in balsam, Hoyer's or an unknown medium from the United States Natural History Museum - National Aleyrodidae Collection (USNM) for the specimens from the Plant Inspection Station (PPQC) some material was prepared using a method modified from Dooley et al. (2010) and in which specimens were soaked in 5% KOH for 24–48 hours, placed in water to remove the potassium hydroxide, then transferred into Essig's aphid fluid for clearing (20 parts of lactic acid, 4 parts of glacial acetic acid, 2 parts of phenol, and 1 part of water). Two drops of double stain (lignin pink, acid fuchsin, lactic acid, and phenol) were added to Essig's aphid fluid for 10 – 15 minutes to stain the specimens. Puparia were transferred to 70% ethanol for 15 minutes and then placed in 90% ethanol for 10 minutes.

After cleaning, the specimens were transferred to clove oil for 15 minutes prior to slide mounting in Canada balsam. One slide was remounted (poor condition) by first soaking it in histoclear for two weeks, raising the cover slip to expose the four puparia and one adult male which were transferred to clove oil, then 95 % alcohol, 70% alcohol, water and back into 5% KOH, soaking for two days before remounting using the above method modified by Dooley et al. (2010).

Microscopic measurements were calculated using a Nikon SMZ 1500 wide-field stereoscope and a Nikon Eclipse 80i compound microscope. Images were taken using a Nikon DS-Fi1 Digital Image camera. Measurements in microns were taken using Nikon DS-L2 software (version 301.1001.0295.070216). All measurements are in microns (μm) with the average indicated in brackets [ ]. The length of the pupal case was measured from the anterior margin of the pupal case to the posterior apex between the caudal setae. The maximum width of the pupal case was measured at the level of the transverse suture. The length of the central process is the distance from the apex of the central process to the center of the lumen of the compound pore. The length of the vasiform orifice is the longitudinal diameter of the opening and the width is the transverse diameter at its widest point both bordering the ring enclosing the vasiform orifice. The distance from the vasiform orifice to the caudal margin was measured from the posterior border of the orifice to the posterior apex equidistant

from the position of the caudal setal bases. The length of the setae was measured from the center of the setal pinaculum to the apex. The description is based on the puparial morphology. The morphological terms used here follow that of Dooley et al. (2010).

Material for this study was loaned by the United States Natural History Museum, Smithsonian Institution and United States Department of Agriculture in Beltsville, Maryland, USA (USNHM) and by the Plant Protection and Quarantine Collection at the South San Francisco Plant Inspection Station, California, USA (PPQC).

### Whitefly Morphology, Taxonomy, and Terminology.

The pupal case is divided into two main regions, the cephalothorax and abdomen, which are separated by the transverse suture. The cephalothorax refers to the cephalon (the most anterior segment or the head, which includes the antennae and mouthparts), the prothorax (segment containing the first pair of legs), the mesothorax (segment containing the second pair of legs), and the metathorax (segment containing the most posterior pair of legs). Pores may be compound, loculate, or simple. The puparia of the genus *Bakerius* have three pairs of compound pores: -a submedian pair on the cephalon and two pairs of abdominal pores. Each compound pore is armed with a central process. Minute loculate and simple pores are distributed predominately around the vasiform orifice but can also be found in other areas of the pupal case. Loculate pores (3-8 locules) are more abundant around the vasiform orifice and at the base of the submarginal teeth. The minute simple pores are solitary or arranged in groups of two to four. The following setae can be found on the pupal case: one marginal pair along the anterior margin of the cephalon and another along the posterior margin of the abdomen; a series of paired cephalothoracic and abdominal submarginal setae; paired dorsal submedian setae on each cephalothoracic segment and abdominal segment 8; ventral setae present or absent at the base of each leg and a pair adjacent to the vasiform orifice.

Abbreviations used for compound pores are CP1 = cephalic compound pore, CP2 and CP3 = Abdominal compound pores. Abbreviations for segments and setae follow Gill (2012) and Martin (1999). Segments: C1 = cephalon, T1 = prothorax (thoracic segment 1), T2 = mesothorax (thoracic segment 2), and T3 = metathorax (thoracic segment 3); A1-A8 = abdominal segments 1 through 8. Setae: AMS = anterior marginal seta, ASDS = anterior subdorsal setae, ASMeS = anterior submedian seta, AVS(T2) = ventral setae at base of T2 leg, AVS(T3) = ventral setae at base of T3 leg, CS = caudal setae, PSDS = posterior subdorsal seta, PSMeS(A1) = posterior dorsal submedian A-1 seta, PSMeS(A8) = dorsal submedian A-8 seta, PMS = posterior marginal seta, PSDS = posterior submarginal seta, PVS(A8) = ventral submedian A-8 seta between the pair of dorsal pockets on A8 and the anterior margin of the vasiform orifice, PVS(VO) = ventral submedian setae lateral to or on the lateral ventral margin of the vasiform orifice.

### Key to puparia of Nearctic and Neotropical genera in the subfamily Aleurodicinae (Hemiptera: Sternorrhyncha: Aleyrodidae).

1. Compound and agglomerate pores absent; puparium pear-shaped, less than twice as long as wide; lingula contained within vasiform orifice ..... ***Dialeurodicus* Cockerell**
- Compound and/or agglomerate pores present; puparium oval to elliptical; lingula contained within or extending beyond the posterior margin of the vasiform orifice ..... **2**
- 2(1). Cephalic compound pores absent; abdominal compound pores numbering no more than 4 submedian pairs ..... **3**
- Pair of cephalic compound pores present; abdominal compound pores numbering from 2 to 6 submedian or subdorsal pairs ..... **4**
- 3(2). Abdomen with 2 or 4 pairs of abdominal submedian compound pores on A1-4; vasiform orifice triangular ..... ***Octaleurodicus* Hempel**



- Abdomen with 2 pairs of submedial compound pores, 1 on A2 and other caudal; vasiform orifice semicircular ..... **Eudialeurodicus Quaintance and Baker**
- 4(2). Two pairs of large abdominal compound pores present, located submedially on A2 and A4 or A3 and A4; agglomerate pores present or absent; vasiform orifice triangular ..... **5**
- More than 2 pairs of abdominal compound pores present, located submedially and/or laterally; agglomerate pores absent ..... **6**
- 5(4). Agglomerate pores present on A5-7 (Fig. 26); compound pores on A3 and A4 ..... **Leonardius Quaintance and Baker**
- Agglomerate pores normally absent (except for one species); compound pores on A2 or A3 and on A4 (Fig. 1) ..... **Bakerius Bondar**
- 6(4). Submedian cephalothoracic setae absent; compound pores always in pairs ..... **7**
- One to four pairs of submedian cephalothoracic setae; compound pores either paired or on one side (asymmetric distribution) ..... **9**
- 7(6). Five abdominal compound pores present and subequal in diameter; each compound pore with an acute, elongate central process ..... **Azuraleurodicus Martin**
- Four to six pairs of abdominal compound pores present; without a protruding central process ..... **8**
- 8(7). At least one of the posterior 3 abdominal compound pores not aligned along a curving arc but rather offset from the inside the lateral margin; stellate pores absent ..... **Aleuronudus Hempel (in part)**
- Abdominal compound pores aligned along a curving arc just inside the lateral margin; stellate pores present or absent ..... **Metaleurodicus Quaintance and Baker**
- 9(6). Anterior 2 compound pores reduced in diameter compared to posterior 4 compound pores; 1 pair of submedian cephalic setae present; thoracic submedian setae absent ..... **Paraleyrodes Quaintance**
- Anterior abdominal pores not reduced in size; cephalothoracic submedian setae present on 2 or more segments ..... **10**
- 10(9). Body asymmetrical, banana-shaped; margin without long setae; compound pores not paired numbering 2 to 4, central processes of each compound pore extending beyond the pore margin ..... **Ceraleurodicus Hempel (in part)**
- Body oval to elliptical not asymmetric; compound pores paired numbering 5-7; central processes (when present) of each compound pore usually terminating well before the margin ..... **11**
- 11(10). Lateral margin of body with 12-15 pairs of setae; abdomen with 6 pairs of compound pores all subequal in size present ..... **Nealeurodicus Hempel**
- Lateral margin of body without setae; submargin with 12 pairs of setae; abdomen with 4 to 6 pairs of compound pores present with 5<sup>th</sup> and 6<sup>th</sup> pair reduced, if present ..... **12**
- 12(11). Six pairs of abdominal compound pores with subequal diameters ..... **Austroaleurodicus Tapia**
- Four to six pairs of abdominal compound pores; if 6 pairs present, then posterior two abdominal compound pores are smaller than others ..... **Aleurodicus Douglas**

***Bakerius* Bondar.**

Type-species: *Bakerius phrygilanthi* Bondar, 1923, by original designation.

**Description (English translation of 1923 description from Portuguese).** Forewing rounded with radius, radial sector, medium and cubitus; generally maculate. Head conical; antenna 7-segmented, of which the third is the longest; genital pincers (=claspers) of the male, long and straight. Nymph with compound wax glands (=compound pores): one cephalic pair and two pairs on the first (and second) abdominal segments. Vasiform orifice reticulated on the bottom (floor) on the second half; lingula included. Margin with a row of large marginal teeth. The wing maculations of the two species of *Bakerius* Bondar are similar to *Leonardius* Quaintance and Baker (1913), *Dialeurodicus* Cockerell (1902), and less to *Quaintancius* Bondar (1923). The genus is named for Dr. A. C. Baker, whose kindness we owe a lot to in the preparation of this work.

**Diagnosis. Puparium habitus.** Body ovoid, widest at level of T3 and A1 setae with cephalic margin evenly rounded and caudal margin slightly obtuse or rounded. Lateral margin crenulate or finely dentate with one or two rows of submarginal glands appearing as row(s) of hyaline teeth that are rounded apically and oriented toward but does not extend past the margin (Fig. 20b). Tracheal and caudal clefts, folds, and furrows indistinct; subdorsal fold absent.

**Dorsum.** Brownish pigmented patches absent or present (Fig. 1). Longitudinal suture terminates at the base of the marginal tooth; transverse suture terminates at the base of the metathoracic leg. The pro-mesothoracic suture terminates less than 1/4 the distance from the midline to the base of the mesothoracic leg; the meso-metathoracic suture terminates about half the distance from the midline to the base of the metathoracic leg. CP1, CP2, and CP3 present with CP1 on cephalon, CP2 on A2 and CP3 on A3 or A4; each compound pore armed with cone or wand-shaped central process. Dorsum of A7 with a pair of pouches directly anterior to the vasiform orifice.

**Vasiform orifice.** Cordate, reticulated on posterior half of orifice, operculum rectangular with lateral rounded margins, a straight anterior margin and a bisinuate (wavy) posterior margin bisinuate. Lingula included within vasiform orifice, with head exposed beyond posterior margin of operculum and with two pairs of subapical setae.

**Pores.** CP1, CP2 (on A2), and CP3 (on A3 or 4) present (Fig. 1); loculate and simple minute pores (Fig. 27) present in a row at the base of the marginal teeth and distributed throughout the pupal case either as solitary or clusters of two or more pores.

**Chaetotaxy.** ASMeS present (C1 near anterior margin, C2 anterior to rostrum), and ASMeS(T1, T2, and T3); cephalothoracic pairs of subdorsal setae present (ASDS); dorsal pairs of abdominal submedian setae present: PSMeS(A8) and CS; PSDS present; PSMeS absent on A1 to A7. Pair of ventral setae present at base of each leg (AVS); PVS absent or present, PVS(A8) and PVS(VO) present.

**Venter.** Antennae extending lateral to the basal segment of the T2 legs; apical two-thirds of antenna annulated. Legs each with a terminating hook-like process with the apical segment of the T1 leg oriented towards the anterior margin and the T2 and T3 legs oriented downwards.

**Diagnosis. Stage 2 and 3 nymphs** (Fig. 3, 9, 10, 12, and 22). Nymphs pale, oval to elongate; with irregular margin; a pair of pouches present anterior to vasiform orifice. CP1, CP2, and CP3 absent in stage 2 but developed in stage 3. Cephalic submedian, subdorsal seta, submedian PSMeS (A8) and CS present; AMS, PMS, PVS(A8 and VO) present or absent; PVS (T2 and T3) present. Legs three segmented and oriented toward the lateral margin; antenna short and with hooked shape.

**Diagnosis. Adult female** (Fig. 5, 14, and 18). Females display little species-specific characters other than the maculations on the wings (Fig. 20f) or lack of them on the hind wings of *Bakerius maculatus* (Penny and Arias 1980). Eleven specimens were available as illustrations, digital images or available for study [*Aleurotartus destructor* Mackie, *Aleurodicus* (Douglas), *Bakerius* (Bondar), and *Paraleyrodes* (Quaintance)]. The cement gland found in some Aleyrodinae has not been found in the Aleurodicinae females to date. The cephalic vertices of *Bakerius attenuatus* and *B. hondurensis*



sp. nov. are angular (cone-shaped) whereas vertices of the other species and genera ranged from truncate to rounded or were undetermined due to distortion.

**Diagnosis. Adult male** (Fig. 6 and 13). The ratio of the length to the width of the A9 segment is a morphologically specific character that may separate *Bakerius* from the other Aleurodicine genera except *Udamoscelus estrellamarinae* Martin.

**Comments.** Bondar (1923) described the genus *Bakerius* from Brazil. Since then, species of the genus have been collected in other Central and South American countries and intercepted from Vietnam in quarantine at Jamaica, New York. This genus differs from all other genera in the pupal stage by having one pair cephalic and two pairs of abdominal compound pores on segment A4 and on either A2 or A3, and the absence (except for one species) of agglomerate pores characteristic of *Leonardius* Quaintance and Baker (1913). Pigmentation of the puparia varies from being entirely pale to variously pigmented (Fig. 1). The pigmented pattern appears to be very constant for all of the species except for *B. attenuatus* that varies greatly from being entirely pale to having large pigmented areas on the dorsal cuticle (as stated in Bondar (1923) and in specimens examined from the USNHM). The body shape of species in the genus also varies from elongate to ovoid and from radially concentric to slightly asymmetric.

Some of the species are only described from the adult form. The adults all have the characteristic maculated wing patterns; with the costa, subcosta, radius, R1, R2, and cubitus veins; and the elongated A9 segment known only in the male. The ratios of the length to width of A9 segment of *Bakerius* ranged from two to five times longer than wide compared to four species of *Paraleyrodes* (0.7 times longer than wide), 20 specimens of *Aleurotartus destructor* (Mackie) and *Aleurodicus* spp. (ranging from 0.8 to 1.7 times longer than wide), *Dialeurodicus* sp. 1.5 times longer than wide, and *Leonardius* sp. 1.6 times longer than wide.

In *Udamoscelus*, the length of the A9 segment is 2 times its width but the aedeagus and wing venation and maculations are not like that of *Bakerius*. The aedeagus in *Bakerius* is simple, curving upwards whereas for *Udamoscelus* the aedeagus is elbowed with two large and possibly up to four smaller fingerlike projections. The wing maculations are the only character so far to allow for the identification of most *Bakerius* species adults.

**Key to the adult stages of the species of *Bakerius*** (Penny and Arias 1980) but does not include all species (key with permission from Penny and Arias).

- |       |  |  |
|-------|--|--|
| 1.    | Hind wings without spots .....   | <b><i>B. maculatus</i> Penny and Arias</b> |
| —     | Hind wings with spots (Fig. 23) .....  | <b>2</b>                                   |
| 2(1). | Forewings with small distinctive spots .....   | <b>3</b>                                   |
| —     | Forewing with diffused spots and opaque areas (Fig. 23) .....  | <b>6</b>                                   |
| 3(2). | Forewing with one distinctive spot between R and Rs veins .....  | <b><i>B. calmoni</i> Bondar</b>            |
| —     | Forewing with two distinctive spot between R and Rs veins .....  | <b>4</b>                                   |
| 4(3). | Forewing with basal costal spot isolated from margin .....   | <b><i>B. sublatus</i> Bondar</b>           |
| —     | Forewing with basal costal spot contiguous with margin .....   | <b>5</b>                                   |
| 5(4). | Hind wing with 8 spots; forewing less than 1900 µm long .....  | <b><i>B. attenuatus</i> Bondar</b>         |
| —     | Hind wing with 7 spots; forewing more than 2000 µm long .....  | <b><i>B. glandulosus</i> Hempel</b>        |
| 6(2). | Forewing with complete apical band (dark opaque area) and subapical band from R vein to costal margin (Fig. 20f) ..... | <b><i>B. phrygilanthi</i> Bondar</b>       |
| —     | Forewing with apical band interrupted and subapical band appearing as spot between R vein and costal margin .....      | <b>7</b>                                   |

- 7(6). Forewing with basal half of costal area and near apical margin without spots ..... ***B. conspurcatus* (Endelein)**  
 — Forewing with spots on basal half of costal area and near apical margin ..... 8
- 8(7). Forewing with 4 large spots between R and M veins; hind wing with minute spots between R and Rs veins (Fig. 23) ..... ***B. sanguineus* Bondar**  
 — Forewing with only 1 large and 2 intermediate spots between R and Rs veins ..... ***B. amazonicus* Penny and Arias**

### Key to the puparia of the species of *Bakerius*.

1. Dorsal cuticle completely pale to yellowish (Fig. 4d, 21a, 24a) or with a brown pigmented patch surrounding only the vasiform orifice (Fig. 1b); pupal shape ovoid to subovoid; dorsal loculate pores absent, or if present, each 2.9-9 µm in diameter ..... 2  
 — Dorsal cuticle with brown pigmented patches in addition to that surrounding the vasiform orifice (Fig. 1b); pupal shape from elliptical to ovoid or may be slightly asymmetric; dorsal loculate pores (Fig. 21c-e, 27) always present and may be numerous around vasiform orifice (numbering more than 10), small to large in diameter 2.5-9 µm with 4 to 8 locules ..... 5
- 2(1). Submargin with two complete rows of parallel-sided teeth with rounded apices, each row with 7 teeth per 100 µm; vasiform orifice 120 µm long by 93 µm wide; lingula spatulate ..... ***Bakerius glandulosus* Hempel**  
 — Submargin with one complete outer apical row of parallel-side teeth with rounded apices and an incomplete inner basal row of teeth with slightly rounded apices appearing as collars with lateral margins not clearly defined; 6-9 teeth per 100 µm; vasiform orifice 75-143 long µm by 68-113 µm wide ..... 3
- 3(2). Dorsal loculate pores large 7-9 µm in diameter with 3-4 locules (Fig. 21c-e), arranged in clusters on the cephalic and abdominal segment below the vasiform orifice and in rows on the thoracic and abdominal segments A1 to A8; when present central spine-like processes are elongate, narrowly acute, its length extending beyond the margin of each compound pore by more than twice the diameter of the compound pore (Fig. 21d); cuticle pale (Fig. 21a) ..... ***Bakerius sanguineus* Bondar**  
 — Dorsal loculate pores small, each 2.9-5.8 µm in diameter with 5-8 locules arranged in one to two irregular rows or uniformly scattered on the cephalothoracic and abdominal segments; central process of abdominal compound pores cone-shaped extending half the length or less from the rim of the compound pore; cuticle pale to pigmented (Fig. 1b, 24a) only around vasiform orifice ..... 4
- 4(3). Cuticle pale with or without a pigmented patch present only around vasiform orifice (Fig. 4a and 4d); pupal case 1312-1795 µm long; loculate pores in one to two irregular rows proximal to the vasiform orifice ranging from 3-6 [5] µm in diameter; vasiform orifice with 7-9 marginal teeth per 100 µm across from the vasiform orifice ..... ***Bakerius attenuatus* Bondar**  
 — Cuticle totally pale without any pigmented patch; 1312-1483 µm long; loculate pores uniformly scattered with those pores proximal to the vasiform orifice ranging from 5 to 7[6] µm in diameter; 6-6.5 marginal teeth per 100 µm measured across from the vasiform orifice ..... ***Bakerius sublatus* Bondar**
- 5(1). Dorsum with a brown, spindle-shaped pattern, anterior margin forming an acute cephalic angle on widening medially, widest in area surrounding the abdominal compound pores, then narrowing to encompass the vasiform orifice (Fig. 1h and 20a); submargin with two rows of well-defined teeth with rounded apices ..... ***Bakerius phrygilanthi* Bondar**

- Dorsum varying in pigmentation from light to dark brown, but not forming an elongate spindle-shaped pattern; submargin with one row of well-defined teeth ..... 6
- 6(5). Pigmentation extending from the cephalothoracic subdorsum to the midline and to the abdominal submedian encompassing the compound pores; pigmentation on anterior margin of cephalon rounded and pigmentation posterior of vasiform orifice forming an acute angle which terminates before the margin; a pale median to submedian area present from A1 to A7 (Fig. 1f, 16a); large to small tessellations present most obvious on dorsal pigmented area of cuticle; central processes of compound pores apically acute; margin finely dentate (Fig. 16d); known only on *Citrus* from Ecuador .. ***Bakerius leei* sp. nov. Dooley and Smith-Pardo**
- Pigmentation not patterned as above (Fig 1a-e, 1g-h); pigmented area with or without large tessellated areas; central processes of compound pores apically acute to fringed; lateral margin of body finely dentate or smooth; not recorded on *Citrus* Linnaeus (Rutaceae) ..... 7
- 7(6). Submargin and subdorsum with a complete pigmented band (Fig. 1e, 11a); a series of large sack-like ventral hyaline tubercles extending from the cephalon to below the vasiform orifice (Fig. 11d, f); patches of stippled cuticle surround each compound pore (Fig. 11b) and four paired agglomerate-like pore patches (Fig. 11f) present lateral to the vasiform orifice extending to but not reaching the A4 compound pores; thoracic tracheal and caudal margins with 5 or 6 submarginal teeth, reduced in width (Fig. 11e); vasiform orifice with posterior tubercle in the shape of an elongated rod oriented toward the caudal margin (Fig. 11f); known only from Honduras ..... ***Bakerius hondurensis* sp. nov. Dooley and Smith-Pardo**
- Dorsum without complete or radially concentric pigmented bands (Fig 1a-d, 1f-h); stippled patches absent; large sack-like ventral tubercles present or absent; tracheal margins usually not modified, but if so, the caudal and posterior abdominal margin with modified teeth; vasiform orifice usually lacking rod-like tubercle; known from Vietnam or South America ..... 8
- 8(7). Pupal case shape elongate-oval with acute to subacute anterior and posterior margins (Fig. 1a, 1g, 19j); tracheal margin with 3-6 teeth and 2-4 caudal marginal teeth directly posterior to the PMS are differentiated, narrower than other marginal teeth (Fig. 19b, 19k); with more than 2 clusters of 2-6 simple pores each present around the vasiform orifice ..... 9
- Pupal case ovoid to sub-ovoid (Fig. 1b, 1c, and 1d) with rounded anterior and posterior margins; tracheal, caudal and posterior teeth subequal in width to other teeth; with no more than 2 clusters of 2-3 simple pores present around the vasiform orifice or such clusters absent.. 10
- 9(8). Dorsum of median to the subdorsal areas with pigmented bands present on T2 extending to the base of the legs, on A2-A6 extending past the compound pores and becoming faint in the subdorsum, on the median of A8 above the vasiform orifice extending to halfway from the posterior margin of the vasiform orifice to the caudal margin (Fig. 1a and 2a); central processes of compound pores acute (Fig. 2d); intercepted on plant material in the US, probably originating from Vietnam ..... ***Bakerius asiaticus* sp. nov. Dooley and Smith-Pardo**
- Dorsum with pigmented cuticle extending from the median and fading at the margin with clear areas surrounding the compound pores with the largest lateral to the vasiform orifice (Fig. 1g and 19a); central processes of compound pores fimbriate apically and subapically (Fig. 19f); known only from Peru on ferns ..... ***Bakerius peruvianus* sp. nov. Dooley and Smith-Pardo**
- 10(8). Pupal case pigmented except for pale margin and areas immediately surrounding the compound pores (Fig. 1c and 7a); central processes of compound pores cone-shaped, curved or straight (Fig. 7b); vasiform orifice elongate constricted below level of pigmented operculum (Fig. 7i) ..... ***Bakerius calmoni* Bondar**
- Pupal case pigmented differently, usually only from the subdorsum towards the median with pale median and submarginal areas (Fig. 1d, 4a, 8a); central processes of compound pores cone shaped and straight; vasiform orifice elongate but not constricted below level of pale operculum ..... 11

- 11(10). Pupal case 1650-2000 µm long with cephalothoracic margin asymmetrically narrowing on one side and evenly rounded on the other side (Fig. 1d and 8a); with a submarginal series of ventral large sack-like hyaline tubercular structures extending from below the vasiform orifice to the cephalothorax (Fig. 8g); submargin with one row of teeth (Fig. 8e); found only on *Baccharis trinervis* in Colombia ..... ***Bakerius colombianus* sp. nov. Dooley and Smith-Pardo**
- Pupal case 1570-1645 µm long with symmetric margins, lacking submarginal ventral series of tubercular structures; submargin with one or two rows of teeth ..... **12**
- 12(11). Pigmentation of cuticle darker only in central area; submargin with two complete rows of teeth; from Brazil on *Mikania amara* Vahl. Willd. (Asteraceae) ..... ***Bakerius marmoratus* Hempel**
- Pigmentation extending from the median into the subdorsum with pale patches surrounding the compound pores and into the cephalothoracic and abdominal median and submedian segments with pale areas (Fig. 1b and 4c); submargin only with one complete set of teeth; from Brazil and Ecuador found on Asteraceae and *Myrtus* species (Myrtaceae) ..... ***Bakerius attenuatus* Bondar**

***Bakerius asiaticus*** Dooley and Smith-Pardo sp. nov.  
(Fig. 1a, 2, and 3)

**Diagnosis.** Puparium of *Bakerius asiaticus* differs from other *Bakerius* species by the following combination of characters: body elongate, tapering toward the cephalic and caudal margins with marginal teeth reduced in width at the tracheal margin and the margin directly posterior to the PMS (Fig. 2c, 2f); dorsum uniformly pigmented (in all puparia examined) as follows: cephalothorax and abdomen pale from the margin to the subdorsum; pigmented spotting on the cephalothorax and pigmented bands on the abdomen both from the subdorsum to the median region interspersed with pale areas; area below vasiform orifice with a dark brown band. *B. asiaticus* differs from *B. peruvianus* by its coloration (Fig. 1a, 1g) and by the central processes of the compound pores being apically acute, whereas in the latter the central processes are fimbriate.

**Description. Puparium habitus.** Measurements in microns (µm) were taken from 17 puparia loaned from the USNHM with the range of measurements followed by the average measurement in brackets [ ]. Shape and coloration in vivo unknown. **Slide mounted puparia.** Body elongate, longer than wide, narrowing (tapering) at the anterior and posterior margins (Fig. 1a, 2a); 1613-1864 [1680] long by 920-1117 [1048] wide with the holotype 1864 long by 1107 wide.

**Dorsal pigmentation.** Pale with brown pigmented patches as follows (Fig. 1a): surrounding the rostrum and the cephalic compound pores, narrowly extending medially to A1 segment; darker subdorsum transverse patches on T2; A3 to A6 each with a brown patch from the subdorsum to median enclosing the abdominal compound pores; transverse pigmented bands on A7 and A8 narrow from subdorsum to median; and a narrow median longitudinal median pigmented patch extending from the posterior margin of the vasiform orifice terminating no more than two-thirds the distance to the pupal margin (Fig. 1a and 2a). Cuticle from T1-A6 with median and submedian transverse and longitudinal striations.

**Margin.** Serrate to smooth margin with irregular striations extending to and between marginal teeth (Fig. 2b and Fig. 2c). Lateral margin with 6-8 [7] teeth/100 µm, holotype having 7 teeth/100 µm. Row of apically rounded teeth, subequal in width and separated; basal area of teeth forming a narrow collar; 2-5 differentiated teeth, reduced in width (Fig. 2b-c, 2j) with the narrowest width of the apical marginal teeth across from the cephalic compound pore and posterior to the PMS (Fig. 2f); with a more finely striated margin apical to the marginal teeth present opposite T1 pairs of legs and approximate to the posterior marginal setae.

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present. Measures for each are as follow: CP1: 33-41 [38] diameter, in holotype 37 and 39, CP2 on A2: 37-53 [44], in the holotype 43 and 49, and CP3 on A4:

37-49 [43] and the holotype: 47 and 49. Central process (when present) is cone-shaped (Fig. 2d), hyaline, with an acute apex, 3 to 4× longer than wide, extending 2 or more times its length from the rim of the pore. Length is measured from the central lumen to the apex: CP1 central process: 56-76 [66] and in the holotype 56 and the other one missing; CP2 process 84-88 [86], the holotype missing the central processes, and CP3 process 74-99 [84] long with that of the holotype as 85. Central lumen consists of an outer annulus (ring of cells) with larger cells and an inner ring with smaller cells. Minute dorsal loculate pores (Fig. 2e and 27), 4-5 locules, with a bright center of 5-7 in diameter present at the base of the teeth and distributed throughout the cuticle from the cephalothorax to the caudal with the pores around the vasiform orifice of the holotype that is 5 to 6 in diameter; simple disc pores of various sizes (not closely associated with compound pore) distributed on the dorsum with 4 or more groups of pores numbering 2 to 5 pores in a cluster around the vasiform orifice (Fig. 2i). Pores within the cluster separated no more than 2× their distance from each other in relation to their diameter.

**Chaetotaxy.** Setae whip-like, apically acute and curved. AMS 21-51 [33] long with the holotype broken off and the PMS 33-72 [53] long (Fig. 2f) with the holotype broken off; ASMeS(C1) 11-27 [19] with the holotype 11 and other C1 setae broken off, ASMeS(C2) 12-27 [20] with the holotype 18 and 18 long, ASMeS(T1) 17-35 [25] with the holotype 23 and 24, ASMeS(T2) 20-34 [28] with the holotype 31 and the other broken off, ASMeS(T3) 22-36 [28] with the holotype 22-28, PSMeS(A8) 17-40 [28] with the holotype 26-29; AVS(T2) 27-46 [35] with the holotype 31 and 33 and AVS(T3) 28-47 [38] with the holotype 37 and 43; PVS(A8) absent and, PVS(VO) (Fig. 2h, i) present on the lateral border of vasiform orifice about midway from anterior margin to base 45-72 [55] with the holotype at 57 and 66; CS present 16-37 [25] with the holotype 16 and 22; 6-7 cephalothoracic and abdominal subdorsal row of setae present (measured 33 setae) on each side with ASDS 6.3-34 [21] and PSDS 10-40 [26] long.

**Vasiform orifice** (Fig. 2i). Cordate in shape, 104-121 long [115] and 84-114 [98] wide with holotype 118 long by 114 wide. Operculum rectangular (Fig. 2g), 53-58 [56] long and 73-84 [79] wide with the holotype being 53 long by 84 wide with rounded lateral margins, a straight anterior margin and a bisinuate posterior margin marked with a spinulose U-shaped band across the posterior and curving laterally to the anterior margin of the operculum (Fig. 2g); lingula (Fig. 2i) conical 49-78 [63] long by 48-65 [58] wide with the holotype 67 long by 65 wide. Distance from posterior margin of vasiform orifice is 225-290 [251] long with the holotype 240.

**Venter.** Legs with the apical segment of the T1 leg oriented towards the anterior margin and the T2 and T3 legs oriented downwards. Long thoracic ventral seta, AVS(T2 and T3), observed on base of the basal segment of each T2 and T3 leg.

**Description. Stage 2 nymph habitus.** Measurements in microns (µm) were taken from one nymph loaned from the USNHM. Pale elongate with anterior and posterior margin acute and widest at the middle (Fig. 3a). Nymph 1230 long by 618 wide. Teeth irregularly formed each with acute projection oriented to margin (Fig. 3d).

**Pores.** Compound pores and central processes absent. Loculate pores (Fig. 3d and 27) present and larger than in puparium from 7 to 8 (µm) in diameter; few simple disc pores present.

**Chaetotaxy** (Fig. 3b-d). AMS present 22 long with the other missing; PMS 23 long with the other missing; ASMeS(C1) 18 and 18 long, ASMeS(C2) 15 and 20 long (Fig. 3b), ASMeS(T1) 13 and 18 long, one ASMeS(T2) 14 long and the other missing, ASMeS(T3) 16 and 26 long, PSMeS(A8) 19 and 19 long (Fig. 3c); one AVS(T2) 14 and the other missing; one AVS(T3) 25 and 25 long (Fig. 3c); PVS(A8) absent; one PVS(VO) 44 (Fig. 3d) and the other missing. Twelve cephalothoracic and abdominal subdorsal row of setae present with ASDS 19 long (Fig. 3b) and PSDS 23 and 44 long (Fig. 3d) (all others broken off).

**Vasiform orifice** (Fig. 3d). Cordate in shape, 96 in long by 77 wide. Operculum rectangular, 35 long by 71 wide; with a bisinuate posterior margin, an undefined anterior margin and rounded lateral margin; marked with a spinulose U-shaped band across the posterior and curving laterally to the anterior margin of the operculum; lingula conical 54 long by 44 wide. Distance from posterior margin of vasiform orifice is 171.

**Venter.** Legs (Fig. 2c and 3a) three segmented each with a terminal claw of the T1 legs oriented toward the anterior-lateral margin and the T2 and T3 legs oriented toward the posterior-lateral



margin. Long ventral seta observed on base of the basal segment of each meso-metathoracic leg (Fig. 3c).

**Description. Stage 3 nymph habitus.** Measurements in microns ( $\mu\text{m}$ ) were taken from one nymph loaned from the USNHM. Pale elongate with anterior and posterior margin acute and widest at the middle (Fig. 3e). Teeth elongate to bullet-shaped (Fig. 3h). Nymph 1282 ( $\mu\text{m}$ ) long by 619 wide.

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 3e) with the following diameters: CP1 29 and 30, CP2 distorted (unable to measure) and CP3 34 and 35 in diameter respectively; central lumen with same pattern as in the puparium, and central processes missing. Loculate pores numerous on dorsum from cephalon to posterior abdominal from submargin to median and larger than in puparium stage from 7 to 9 ( $\mu\text{m}$ ) in diameter; few simple disc pores present from cephalon to below the vasiform orifice.

**Chaetotaxy.** AMS missing; PMS 28 long (Fig. 3h); ASMeS(C1) 18 long (Fig. 3e) and other seta broken off; ASMeS(C2) 16 long and other seta broken off, ASMeS(T1) 16 and 20 long, ASMeS(T2) 22 and 25 long, ASMeS(T3) 27 and 31 long, PSMeS(A8) 23 and 25 long; AVS (T2) 11 and other seta broken off, AVS (T3) 9 and 15 long (Fig. 3g), PVS(A8) 37 and 39 long, PVS (VO) 27 and other seta broken off; CS 27 long and other seta broken off. Six cephalothoracic and six abdominal subdorsal rows of setae present on each side with one ASDS 19 (all others broken off) and two PSDS 23 and 44 long (all others broken off).

**Vasiform orifice** (Fig. 3h). Cordate in shape, 976 in long by 776 in wide. Operculum rectangular, 40 long by 66 wide with a bisinuate posterior margin, a defined straight anterior margin, and rounded lateral margin; marked with a spinulose U-shaped band across the posterior and curving laterally to the anterior margin of the operculum; lingula conical 51 long by 44 wide. Distance from posterior margin of vasiform orifice is 174.

**Venter.** Legs three segmented each with a terminal claw of the T1 legs oriented toward the anterior-lateral margin and the T2 and T3 legs oriented toward the posterior-lateral margin. Ventral seta observed at base of first segment of each meso-metathoracic leg (Fig. 3g).

**Etymology.** Named after the region from which it is reported: Asia.

**Distribution.** Oriental: from Vietnam? (origin unclear) in quarantine at Jamaica, New York.

**Material examined.** Holotype (puparium). Vietnam, intercepted on an undetermined plant at USDA-PPQ- Port-of-Entry at Jamaica, New York. 6-viii-1994, Mike Schuble coll. Canada balsam slide 95-01248a, deposited in the USNHM.

Paratypes (USNHM): *same data as the holotype except slide numbers as follows:* 6 puparia 95-01248a, 7 puparia 95-01248b, 3 puparia JFK980997938400; 3 nymphs (2nd and 3rd stage) 95-01248c (USNHM).

**Host.** Unknown.

**Comments.** This is the only *Bakerius* species intercepted from outside of the Americas. Since *Bakerius* is a Neotropical genus and these specimens were intercepted in quarantine at JFK International Airport on plant material arriving in passenger baggage from Vietnam, the true origin of the species is uncertain.

***Bakerius attenuatus*** Bondar 1923  
(Fig. 4-6)

**Description. Puparium habitus.** Measurements in microns ( $\mu\text{m}$ ) were taken from 15 specimens from the USNHM. Ovoid, wider in the posterior half (Fig. 4a,b). The pigmented pattern is variable.



**Slide mounted puparium.** Ovoid shape (Fig. 4a) with puparium 1312-1989 [1630] long by 902-1356 [1144] at its greatest width.

**Dorsal pigmentation.** Pale to variable brown pigmentation arranged from surrounding only the vasiform orifice to covering the entire subdorsum and surrounding all the compound pores (Fig. 1b and 4a-c); if pigmented around the vasiform orifice, then with tessellated (best seen with phase contrast) or smooth cuticle; tessellated cuticle absent in a pale specimen; the submargin to subdorsum pigmented patches may extend from below the vasiform orifice to the thoracic segments from the submargin to the subdorsum.

**Margin** Puparial margin smooth with small amorphous granules between the margin and the outer row of teeth. Row of apically rounded marginal teeth (Fig. 4g), subequal in width, and separated; basal area of teeth forming a narrow collar; with slightly reduced width of teeth only across from the C1 compound pore; 2-4 pronged forked structures extend from the base between each marginal tooth (Fig. 4g) to the margin (best seen with phase contrast).

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 4a-d) with the following diameters: CP1 compound pore: 43-69 [57], CP2 compound pore 51-74 [61], and CP3 50-74 [60]. Central process is narrow, light brown, and slightly imbricated when present extending less than half its length from the rim of the pore (Fig. 4e) with the following lengths: C1 central process: 42-65 [52], A2: 45-81 [69], and A4: 34-65 [53]; central lumen consists of an outer annulus (ring of cells) with larger cells and an inner ring with smaller cells. Loculate pores present (Fig. 4i) from the thoracic to the caudal margin and from base of the marginal teeth to the median ranging in diameter 3-6 [5] with 31 pores measured. Simple disc pores distributed on the dorsum with 7-12 pores uniformly circling each compound pore and other disc pores along submedian dorsal cuticle. Reticulated floor of vasiform orifice with simple disc pores (Fig. 4h).

**Chaetotaxy.** AMS 12-38 [29] long and PMS 27-63 [50] long with the longest PMS on the specimens with a pigmented area around the vasiform orifice; dorsal submedian setae (ASMeS and PSMeS) present (Fig. 4f and j) on segments C1, C2, T1, T2, T3, A8, with lengths: ASMeS(C1) 11-28 [18], ASMeS(C2) 17-23 [19], ASMeS(T1) 12-35 [23], ASMeS(T2) 8-37 [25], ASMeS(T3) 13-38 [25], PSMeS(A8) 23-69 [46]; AVS(T2) 23-38 [3111] and AVS(T3) 21-40 [31], PVS (VO) 18-76 [47] in lateral border of vasiform orifice about half way from anterior margin to base (Fig. 4h), and AVS (A8) absent; CS present 10-49 [36]; 6-7 subdorsal setae present on cephalothoracic and abdominal segments: ASDS 10-42 [23] and PSDS 10-47 [34].

**Vasiform orifice** (Fig. 4h, j). 114-143 [127] long and 79-113 [98] with posterior floor of vasiform orifice reticulated with disc pores visible through the lingula (Fig. 4h); operculum rectangular 54-73 [62] long and 62-83 [77], with a bisinuate [what does bisinuate mean?] posterior margin and marked with a spinulose U-shaped band (Fig. 4j); lingula conical 58-83 [73] long by 47-66 [56] wide; tubercle present on posterior border of orifice. Distance from posterior margin of vasiform orifice is 139-242 [189].

**Venter.** Forelegs oriented toward the anterior margin and the middle and hindlegs oriented toward the posterior margin; each with a terminal claw. Long ventral seta, AVS(T2 and T3), observed at base of the basal segment of each meso-metathoracic leg.

**Description. 2nd and/or 3rd instar nymph. Habitus.** Puparium slightly yellowish pale becoming blood red disappearing a day before the adult emerges (based on translation of Bondar 1923). No specimens observed.

**Description Adult female. Slide mounted** Adult. Measurements in microns ( $\mu\text{m}$ ) were taken from one specimen from the USNHM with a dissecting microscope at 5x power: length from the cephalic vertex to the apical end of the ovipositor is 1249 long by 3466 its widest thoracic point.

**Cephalon.** Angular and apically acute at the vertex between the antenna (Fig. 5b). Antenna seven segmented: segment one pair spinulose 476 and 576 long by 57 and 61 wide, segment two 122 and 128 long with an apical sensory pit and 5 setae, segment 3 at 435 and 448 long with transverse bands of minute microtrichia and five noncontiguous sensory pits subapically to apically, segment four 204 and 206 long, segment five 166 and 172 long, segment six 70 and 89 long, and segment seven 51 and 53 long. Ocellus proximal to the anterior inner margin of each compound eye distorted in

shape. Compound eye appears undivided. Between ocelli and compound eyes are dorsal (Fig. 5b), and ventral cephalic patches of small spinules (Fig. 5c); between these spinulose rows and the ocular areas is a pair of longitudinal dorsal row of setae with varying lengths no longer than the diameter of the associated ocellus. Ventral cephalic area from between the antennae progressing to the anterior border of the rostrum with setae varying from 29 to 49  $\mu\text{m}$  in length. Three pairs of setae forming a row on the anterior margin from the vertex to the basal antennal segment.

**Legs.** Three pairs of legs terminating in two curved claws and a long, slender and acute paronychium present on the basal segment of the claw. Trochanters and femora with two to three large irregular pores basally present at least on T3; leg 2 tibia with 2 lateral pairs of tibial brushes each with 4-5 setae (Fig. 5g); leg 3 tibia with a comb of two rows of setae and a brush with 5 setae (Fig. 5h).

**Wings.** Forewing with two distinctive spot between R and Rs veins; forewing with two distinctive spot between R and Rs veins and basal costal spot contiguous with margin; hind wings with 8 spots (Penny and Arias 1980).

**Abdomen.** Pale and finely spinulose with a transverse row of setae directly anterior to the vasiform orifice.

**Vasiform orifice.** Orifice (Fig. 5e, 5h) slightly cordate with operculum truncate with dorsum spinulose, 174 long by 92 wide; spatulate lingula 71 long by 52 wide. Ovipositor (5d) structure consists of the inner (second) and outer (first) valvifers (Fig. 5a), paired gonophyses (with an apical pair of setae each), unpaired gonophyses, and ovipositor terminating in two long acute blades with a pair of long setae (35 and 32  $\mu\text{m}$  long) present midway on each blade. Cement gland absent.

**Description. Adult male.** Measurements in microns ( $\mu\text{m}$ ) were taken from one specimen from the USNHM. **Slide mounted.** Body (measured from the cephalic vertex to the apical end of the claspers) 1822 long and 295 at its widest point of the thorax.

**Cephalon.** Truncate between the antennae; antenna seven segmented: segment one spinulose 401 long, segment two 112 long with an apical sensory pit and 5 setae, segment three 432 long with transverse bands of minute microtrichia and two noncontiguous sensory pits subapically, segment four 226 long, segment five 150, segment six 83, and segment seven 47. A pair of ocelli proximal to the anterior inner margin of each compound eye about 30 in diameter. Compound eye appears undivided. Between ocelli and compound eyes are dorsal and ventral patches of small spinules; between these spinulose rows and the ocular areas is a pair of a longitudinal dorsal row of setae with varying lengths no longer than the diameter of the associated ocellus. Setae between the ocelli numerous and varying in length with some longer than the diameter of the ocellus.

**Legs.** 3 pairs of legs terminating in two curved claws and a long, slender and acute paronychium present on the basal segment of the claw. Trochanters and femora each with two to three large irregular pores basally; tibia of middle leg with a two pairs of tibial brushes each with 6 setae; metatibia with a comb of two rows of setae and a pair of brushes with 3 setae (Fig. 6f).

**Wings.** Forewing with two distinctive spots between R and Rs veins; forewing with two distinctive spots between R and Rs veins and basal costal spot contiguous with margin; hind wings with 8 spots (Penny and Arias 1980).

**Abdomen.** All abdominal dorsal sclerites with clusters of discoidal pores extending to and surrounding the vasiform orifice; ventral sclerites with clusters of discoidal pores extending from A3 to beyond the posterior margin of the vasiform orifice (Fig. 6g). A8 segment elongated, tubular-shaped (Fig. 6b) 733 long by 259 wide (2.8 times longer than wide) with an irregular transverse row of setae on the apical margin.

**Vasiform orifice.** Orifice distorted, unable to measure orifice, operculum, or lingula. Vasiform orifice with pore clusters on elongated abdominal segment (Fig. 6h). A pair of curved claspers from 550-561 long with an acute apex and a row of small setae on the dorsal and ventral surface of each clasper (Fig. 6b); aedeagus curved 248 long and curved subapically.

**Distribution.** Neotropical: Brazil, Colombia, Ecuador.

**Host.** Asteraceae; Loranthaceae, *Myrtus* sp. (Myrtaceae) and unknown host.

**Material examined.** One puparium misidentified as *B. intermedius*, Brazil on myrtle (*Myrtus* sp.) 1973 by J. Bondar (Q20632); two puparia misidentified as *B. sanguineus* Bondar (listed as cotype on the slide but identified as *B. attenuatus* by A. B. Hamon, 29-viii-1978; two puparia (2 slides, Q20632), Brazil on myrtle, 1973 by J. Bondar; one puparium, Bahia, Brazil on Loranthaceae, date unknown, J. Bondar; five puparia: Bahia, Brazil on unknown plant, 1923 by J. Bondar. (Q23297); 3 puparia: Alejandria (Ant.), Colombia on composite plant, 1972 by R. Valez (72-5078, #9); six puparia and one 2<sup>nd</sup> stage nymph, S. D. De Los Colorados, Ecuador on unknown plant, 5-xii-74 E.J.Hambleton, #21. One adult female and one adult male: Alejandria (Ant.), Colombia on composite plant, 1972 by R. Valez (72-5078, #9). Deposited in the USNHM.

**Comments.** This is the only species with both the pale and pigmented forms of the puparium (Fig. 4a-d). The pigmentation is extremely variable with various patterns cited in Bondar (1923) and also observed in specimens deposited in the USNHM collection. The pupal length and width and the extent of the pigmentation vary depending upon the country from which the specimens were collected. The puparia from Ecuador were the largest, 1945-1987 long; followed by those from Colombia 1771-1796 long; and the smallest from Brazil 1313-1549 long (as recorded by Bondar). The coloration of the puparia varies from completely pale or pigmented only around the vasiform orifice to being pigmented on the cephalothorax and the abdominal regions. The pale form of *B. attenuatus* differs from *B. glandulosus* by having one complete row of marginal teeth as compared to the latter with two complete rows (Hempel 1938); from *B. sanguineus* by the size of the loculate pores which are 3 to 6 µm in diameter in the former, whereas those of the latter are 7-9 µm in diameter. The pigmented form varies in the coloration pattern from being only pigmented around the vasiform orifice to being pigmented on the cephalothorax and the abdominal regions. The puparium shape is ovoid compared to the elongated shape and the acute anterior and posterior margins in *B. asiaticus* and *Bakerius peruvianus* Dooley and Smith-Pardo sp. nov.

***Bakerius calmoni* Bondar 1928**  
(Fig. 7a-k)

**Description. Puparium habitus.** (Based on translation of Bondar 1928). Body ovoid (Fig. 7a), wider near posterior margin; 1600 µm long by 1200 µm wide, yellowish pale, with a slight smoky appearance except on the dorsal posterior submarginal area of the abdomen. **Slide mounted puparium.** Measurements in microns (µm) [were taken from four specimens from the USNHM. Body ovoid 1571-1640 [1606] long by 1053-1149 [1101] wide.

**Dorsal pigmentation.** (Fig. 1c, 7a). Cuticle pigmented light brown except for the marginal teeth and the margin and the area immediately surrounding the compound pores which are yellowish-pale. Area surrounding vasiform orifice pigmented darker brown than the rest of the cuticle with a faint tessellated pattern directly below and adjacent to the lateral margins of the vasiform orifice, becoming darker around the vasiform orifice.

**Margin.** Row of apically rounded teeth (Fig. 7c), subequal in width, and separated; basal area of teeth forming a narrow collar; 2-4 pronged forked structures (Fig. 7d) extend from the base between each marginal tooth to the margin. Puparial margin smooth with small amorphous granules between the margin and the outer row of teeth.

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present with the following diameters: CP1: 55-61 [58], CP2: 56-67 [61], and CP3 (Fig. 7e): 54-62 [58]. Central process (Fig. 7b) is cone shaped, light brown, slightly curved and imbricated when present extending half its length from the rim of the pore with the following lengths: CP1 process: 58-67 [63], CP2 process: 56-79 [67], and CP 3 process central process: 56-75 [65]; central lumen consists of an outer annulus (ring of cells) with larger cells and an inner ring with smaller cells. Minute loculate pores present primarily at the base of the teeth and scattered on the dorsum; simple disc pores of various sizes distributed on the dorsum not closely associated with compound pore (Fig. 7j); 8-12 disc pores present on the reticulated floor (Fig. 7h,k) of the vasiform orifice.

**Chaetotaxy.** (Fig. 7f). AMS 21-25 [23] and PMS 24-38 [31]; ASMeS and PSMeS (Fig. 7f and i) present on segments C1, C2, T1, T2, T3, A8, with lengths: ASMeS(C1) 11-27 [19], ASMeS(C2) 17-22 [19], ASMeS(T1) 15-26 [20], ASMeS(T2) 15-30 [22], ASMeS(T3) 18-26 [22], PSMeS(A8) 30-50 [40]; ventral setae present, AVS(T2) 24-33 [27], AVS(T3) 25-39 [33], PVS(A8) absent, PVS(VO) 24-36 [30] (Fig. 7h) on the lateral border of vasiform orifice about half way from anterior margin to base; CS present 19-46 [33]; six submarginal setae present on each side of the cephalothoracic and abdominal segments with ASDS 13-32 [19] and PSDS 14-31 [23] with eight setae sampled.

**Vasiform orifice.** (Fig. 7g). Elongate with slight lateral narrowing (Fig. 7i) below level of operculum and 117-125 [120] long and 85-98 [90] wide with posterior floor of vasiform orifice reticulated (Fig. 7h,k) with disc pores visible through the lingula; operculum (Fig. 7i,k) rectangular, 59-63 [61] long and 82-86 [84], with a bisinuate posterior margin and marked with a spinulose U-shaped band; lingula (Fig. 7i,k) conical 66-78 [74] long by 57-76 [62] wide; tubercle present on posterior border of orifice. Faintly tessellated (Fig. 7h) posterior to and lateral of the vasiform orifice (best seen at 40x phase contrast). Distance from posterior margin of vasiform orifice is 156-165 [160].

**Venter.** T1 legs oriented toward the anterior margin and the T2 and T3 legs oriented toward the posterior margin; each with a terminal claw. Long ventral seta, AVS (T2) and AVS (T3), observed at base of the first segment of each meso-metathoracic leg.

**Distribution.** Neotropical: Brazil.

**Host.** *Loranthus* Jacq. (Loranthaceae).

**Material examined.** 3 puparia (1 slide), collected November 1948 by A. de La Costa Lima on *Loranthus* from Universidade Rural, D. F. Brazil, deposited in the USNHM.

**Comments.** This species has a consistent pigmentation pattern that differs from that of the other *Bakerius* species in that it has a dark area that covers the entire dorsum except for a pale crescent area at the posterior apex. The shape of the vasiform orifice differs from other species in being more elongate with the anterior margin truncate, the anterior lateral margins rounded, the posterior lateral margins slightly indented just below the level of the operculum, and the posterior margin rounded.

***Bakerius colombianus*** Dooley and Smith-Pardo, sp. nov.  
(Fig. 8-10)

**Diagnosis.** This species differs from most of the pigmented species by the slightly asymmetric **bisinuate** lateral cephalothoracic margin on one side and radially concentric on the other, and by the pigmented pattern of the cuticle becoming pale at the areas immediately surrounding the abdominal compound pores and the median and submedian areas of A1 to A3 (Fig. 1d, 8a).

**Description. Puparium habitus.** Shape and coloration in vivo unknown. Measurements in microns ( $\mu\text{m}$ ) were taken from 13 puparia from the USNHM. **Slide mounted puparium.** Body ovoid to narrowing toward the cephalic margin and widest at the level of A2 (Fig. 8a); 1650-1999 [1811] long by 1121-1377 [1287] wide with the holotype 1893 long by 1375 wide.

**Dorsal pigmentation** (Fig. 8a). Two pigmented brown patches present in the subdorsal to median region: one on the cephalothorax above the rostrum extending between the cephalic compound pores to the transverse suture on the inner margins of the legs and the other with a dark patch extending from the subdorsum of A2 tapering to posterior margin of the vasiform orifice and becoming faint below the orifice; the remaining cuticle pale (Fig. 1d, 8a). Longitudinal suture terminates at the basal margin of the marginal teeth and the transverse suture terminates at the base of the T3 leg. A1 to A8 sutures present and each associated with a pair of shallow submedian depressions.

**Margin.** Puparial margin finely dentate at 40x with striations from the margin to and between the apical marginal teeth (Fig. 8d and e). Row of apically rounded marginal teeth, subequal in width; with 6-7 [6] teeth per 100  $\mu\text{m}$ .



**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 8a-b); only the abdominal compound pores are surrounded by a stippled area. CP1 pore diameter: 44-611 [53] with the holotype: 55 and 57; CP2 diameter: 54- 78 [67] with the holotype: 75 and 78; and CP3 diameter: 50-78 [65] with the holotype: 71 and 78. Central lumen consists of a clear center with an outer annulus (ring of cells) with larger cells and an inner ring with smaller cells surrounding the central process (Fig. 8b). Central process (Fig. 8a, b, c) extends well beyond the rim of the pore, cone shaped, elongated, light brown, and with longitudinal striations; length of the cone is measured from the base at the central lumen to the apex: CP1 length: 43-80 [66] long and the holotype: 77 and 80; CP2: 72-103 [90] and the holotype: 97 and 103, and CP3: 61-91 [75] and the holotype: 86 and the other broken off and 98. Minute dorsal loculate pores (Fig. 8f) distributed from the submargin to the median and from the cephalon to below the vasiform orifice and forming a submarginal row at the base of the inner row of teeth between 2 to 4 teeth intervals (Fig. f). Simple disc pores of various sizes distributed on the dorsum including the areas surrounding the compound pores mostly single but at most 3-4 clusters of 2 pores per cluster.

**Chaetotaxy.** ASMeS and PSMeS (Fig. 8c) present on segments with C1 close to the anterior submargin, C2 anterior and lateral margin of the rostrum, T1, T2, T3 and A8; ventral T2 and T3 setae (AVS), each seta present at midpoint of basal segment of leg; PVS(VO), lateral to or directly from the floor of the orifice directly below the level of the operculum; PVS(A8) absent. Subdorsal and submedial setae with a pigmented pinaculum that is 2 times wider in diameter than the diameter of the setal base. AMS (Fig. 8d) 25-50 [38] long with the holotype 33 and 35 and PMS (Fig. 8h) 50-65 [58] long with the holotype 62 and 65; dorsal submedial setae (ASMeS and PSMeS) present on segments C1 (close to the submargin), C2 (anterior and lateral margin of the rostrum), T1, T2, T3 and A8, measuring in length: ASMeS(C1) 12-31 [22] with the holotype 27 and 28, ASMeS(C2) 12-34 [23] with the holotype 21 and 28, ASMeS(T1) 18-35 [25] with the holotype 19 and the other broken off, ASMeS(T2) 26-38 [32] with the holotype 38 and the other broken off, ASMeS(T3) 24-59 [36] with the holotype 311 and 38, PSMeS(A8) 34-56 [46] with the holotype 433 and 50; ventral AVS(T2) 21-50 [30] with holotype 21 and 26, AVS(T3) 18-45 [32] with holotype 24 and 25, PVS (A8) absent, and PVS(VO) (Fig. 8g) setae present (on the submedian of vasiform orifice ventrad of the operculum) 48-79 [62] with the holotype 59 and the other broken off; CS present at the base of the inner teeth 19-40 [33] with the holotype 30 and the other broken off. 10-12 ASDS with 55 setal lengths measured and 13-14 PSDS subdorsal row of setae (from 52 sampled setal lengths) measured: ASDS 10-34 [23] with the holotype at 10, 13, 13, 15, 19, 20, 22, and 26 long; PSDS: 17-50 [27] long and the holotype: 19, 25, 28, and 32 long.

**Vasiform orifice.** Cordate in shape with posterior floor reticulated (Fig. 8g); measured 108-135 [125] long and 91-111 [100] wide with the holotype: 126 long by 101 wide; operculum rectangular with a uniform rounded posterior margin and marked with a narrow spinulose U-shaped band and a median granular pattern (Fig. 8g), 58-70 long [66] long and 65-91 [83] wide with the holotype being 707 long by 833 wide; lingula spatulate (slightly longer than wide) (Fig. 8g) and spinulose 55-72 [65] long by 56-67 [61] wide with the holotype 65 long by 63 wide; tubercle present on posterior margin of orifice with the base oval-shaped and with a tubular projection flap to funnel shaped (6-10 in diameter) subequal in length and width extending slightly into the abdomen (tubular structure absent in 9 of 23 puparia). Distance from posterior margin of vasiform orifice to the margin between the caudal setae is 206-258 [239] with the holotype 258 long.

**Venter.** Venter with large tubercular or globular structures forming a row below the vasiform orifice (Fig. 8h) extending to the outside margin of T1. Ventral cuticle posterior to and laterad of the vasiform orifice normally tessellated (Fig. 8g), best seen under phase contrast) but smooth in 5 of 23 specimens observed. Antennae long extending into and lateral of the T2 legs. T1 legs oriented toward the anterior margin and the T2 and T3 legs oriented toward the posterior margin. Legs terminating in a claw with a long seta associated at the midpoint basal margin of each T2 and T3 legs and a pair of smaller setae at the anterior basal margin.

**Description. Nymph habitus (Stage 3). Slide mounted stage-3.** Measurements in microns ( $\mu\text{m}$ ) were taken from two nymphs from the USNHM. Pale (Fig. 9a), longer than wide, widest between abdominal segments 1 and 2; 1172-1247 [1209] long by 722-737 [730] wide; longitudinal suture poorly developed or absent; transverse suture terminates below the metathoracic legs. Dorsal cuticle with irregularly shaped striations forming from the base of the marginal teeth to the subdorsum; faint

tessellations present (visible under 40x phase); A1 to A8 sutures present.

**Margin.** Finely dentate with a row of irregular marginal teeth.

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 9a); central lumen consists of a clear center with an outer annulus (ring of cells) with larger cells and an inner ring with smaller cells (Fig. 9c); CP1 compound pore diameter: 48-51 [50]; CP2 pore diameter: 61-67 [63]; and CP3 diameter: 56-63 [59]. Central processes absent. Minute dorsal loculate and simple pores not abundant but sparsely distributed from the submargin to the median and from the cephalon to below the vasiform orifice.

**Chaetotaxy.** ASMeS and PSMeS present on segments with C1 close to the anterior submargin, C2 anterior and lateral margin of the rostrum, T1, T2, T3 and A8; AVS(T2, T3) setae (Fig. 9b), each seta present at midpoint of basal segment of leg; and PVS arising on A8 lateral to or directly from the floor of the orifice directly below the level of the operculum (Fig. 9d); AMS (Fig. 9c) 24-28 [26] long, 12 ASDS (from 17 sampled setal lengths): 12-31 [21], ASMeS(C1) 14-28 [23], ASMeS(C2) 20-25 [23], ASMeS(T1) 19-28 [25], ASMeS(T2) 26-27 [26], AVS(T2) 16-21 [19], ASMeS(T3) 20 (all others broken off), AVS(T3) 16-29 [23]; PMS (Fig. 9d,e) 40-47 [44] long, 12 PSDS with 8 lengths 27-38 [34] with many broken off, PSMeS(A8) 37-42 [40], PVS(A8) 35-68 [55], PVS (VO) 30-33 [31], and CS (Fig. 9e) present at the base of the inner teeth with all others broken off.

**Vasiform orifice.** Cordate in shape (Fig. 9d, e); measured 94-97 [96] long and 82-93 [88] wide; operculum rectangular with a straight anterior margin, rounded lateral margins and a lightly bisinuate posterior margin marked with a narrow spinulose U-shaped band; operculum: 43-45 [44] long and 77-82 [80] wide; lingula spatulate (slightly longer than wide) and spinulose 56-63 [60] long by 50-56 [53] wide with two pairs of subapical setae; tubercle present on posterior border of orifice from oval to a tapering flap extending into the abdomen: 9-13 [11] wide. Distance from posterior margin of vasiform orifice to the margin between the caudal setae is 119-134 [126].

**Venter.** Antennae short, apex bent and positioned anterior to the T1 legs (similar to Fig. 10c). T1 legs oriented toward the anterior lateral margin and the T2 and T3 legs oriented toward the posterior lateral margin. Legs three segmented terminating in a claw and with a long seta, AVS (T2 and T3) associated at the midpoint on the basal segment of each T2 and T3 legs (Fig. 9b).

**Description. Nymph habitus (Stage 2). Slide mounted stage-2.** Measurements in microns ( $\mu\text{m}$ ) were taken from seven nymphs from the USNHM. Pale, elongate, slightly tapering to the cephalic margin, widest between A1 and A2 (Fig. 10a); 1180-1242 [1218] long by 713-781 [743] wide. Longitudinal suture poorly developed anterior to the margin of the cephalon or absent; transverse suture terminates below the level of the T3 legs. Faint tessellations present (most visible under 40x phase below the vasiform orifice; A1 to A8 sutures present. The remainder of the dorsal and ventral cuticle is smooth unless otherwise noted.

**Margin.** Finely dentate with a row of irregular marginal teeth (Fig. 10b). Dorsal cuticle with irregularly shaped striations forming from the base of the marginal teeth to the subdorsum.

**Pores.** Compound pores absent. Minute dorsal loculate and simple pores not abundant but sparsely distributed from the submargin to the median and from the cephalothorax to below the vasiform orifice.

**Chaetotaxy.** AMS and PMS (Fig. 10f) present; ASMeS and PSMeS present on segments with C1 close to the anterior submargin, C2 anterior and lateral to the rostrum, T1, T2, T3 and A8; AVS(T2, T3) setae (Fig. 10d), each seta present at midpoint of basal segment of leg; a pair of ventral setae, PVS(VO), lateral to or directly from the floor of the orifice directly below the level of the operculum and a pair; and PVS(A8) present in one specimen and absent in 6 specimens: AMS 20-28 [23] long, 12-13 pairs of ASDS present (15-35 [25] taken from the lengths of 49 setae sampled, ASMeS(C1) 16-31 [22], ASMeS(C2) 13-23 [19], ASMeS(T1) 15-29 [23], ASMeS(T2) 13-29 [22], AVS(T2) 13-21 [18], ASMeS(T3) 19-26 [22], AVS(T3) 16-21 [19]; PMS 38-58 [46] long, 11-13 PSDS with 47 lengths 17-48 [26], PSMeS(A8) 21-33 [27], PVS(A8) only one nymph with setal pair broken off, PVS (VO) 30-44 [36], and CS (Fig. 10e) present at the base of the inner teeth 25-45 [33].

**Vasiform orifice.** Cordate in shape (Fig. 10e) with posterior floor reticulated; measured 94-104 [98] long and 87-99 [91] wide; operculum (Fig. 10e) with a straight anterior margin, rounded lateral margins and a lightly bisinuate posterior margin marked with a narrow spinulose U-shaped bisinuate band; operculum: 44-46 [45] long and 76-80 [79] wide; lingula spatulate (slightly longer than wide)



and spinulose 51-70 [57] long by 50-56 [53] wide with two pairs of subapical setae; tubercle present on posterior border of orifice from oval to a tapering flap extending into the abdomen 7-11 [9] wide. Distance from posterior margin of vasiform orifice to the margin between the caudal setae is 124-130 [124].

**Venter.** Antennae short, apex bent and positioned anterior to the T1 legs lateral to the rostrum (Fig. 10e). T1 legs oriented toward the anterior lateral margin and the T2 and T3 legs oriented toward the posterior lateral margin. Legs three segmented terminating in a claw with AVS(T2 and T3) associated at the midpoint on the basal segment of each leg (Fig. 10d).

**Etymology.** Named after Colombia, the country in which it was collected.

**Distribution.** Neotropical: Colombia.

**Host.** *Baccharis trinervis* (Lam.) Pers. (Asteraceae).

**Material examined.** Holotype (puparium). From Bello, Antioquia, Colombia on *Baccharis trinervis* (Lam.) Pers. (Asteraceae). 28-II-1985 by F. Posada; 86-5599, # 1671; deposited in the USNHM.

Paratypes (22 Puparia, 2 stage 3 and 7 stage 2 nymphs). Same data as on holotype; deposited in the USNHM.

**Comments.** Known only from Colombia on the leaves of *Baccharis trinervis*.

### ***Bakerius glandulosus* Hempel**

**Description** (English translation of Hempel 1938). **Puparium habitus.** Yellow in color, oval, with rounded posterior margin, sometimes with the anterior margin a slightly acuminate; 1623 µm long by 1177 µm wide. The fringe of white wax around the margin of the body measures 238-280 µm in length. Dorsum with three pairs of compound pores, one cephalic pair and two abdominal pairs. These glands form a cup with numerous cells or grooves on the inner wall and a central process that is horn-shaped. The two cephalic compound pores are slightly smaller than the abdominals, about 50 µm in diameter, while the abdominal pairs each are around 58 µm. The abdominal dorsal segments are clearly indicated. Vasiform orifice large and cordate with anterior margin straight about 120 µm in length and about 93 µm wide; The lingula large, spatulate and inserted, surface entirely asperate with four subapical setae; the operculum, slightly wider than long with posterior margin bisinuate. The margin of the pupal case with small incisions and the submargin with a double row of teeth more large and rounded; 10 teeth occupy 152 microns; teeth enclose five incisions between two marginal teeth.

**Nymph. Habitus.** On the underside of leaf and sometimes in great abundance. The shape is oval, with the posterior part of the body a little wider than the anterior half. The color is grayish or light yellow, with a narrow fringe of white wax around the margin. The dorsum with six curved tubes of wax; and when there are many individuals on the leaf, these tubes form a thick layer on top of the insects. Such tubes can reach 14 µm. in length, or more. Translation from Hempel 1938 with no specimen or illustration available.

**Distribution.** Neotropical: Brazil.

**Host.** *Mikania amara* (Vahl) Willd. (Asteraceae).

**Material examined.** No specimens or illustrations available.

**Comments.** This species was cited in Hempel (1938) as having two rows of fully developed marginal teeth. All other pale species with one row of fully developed teeth (translation from Hempel 1938).

Similar to *B. marmoratus* Hempel 1938 that also has two rows of teeth but differs from *B. glandulosus* by being “dark” in the center (Bondar 1938).

***Bakerius hondurensis*** Dooley and Smith-Pardo sp. nov.  
(Fig. 11-15)

**Diagnosis.** This is the only species observed with the combination of the following characters: a complete radially concentric pigmented band (Fig. 1e, 11a) joined at the cephalic and caudal areas below the vasiform orifice; areas surrounding the compound pores and four defined areas on each side of the abdomen from the vasiform orifice to the A4 compound pore with stippled cuticle (Fig. 11b, c); the vasiform orifice with a rod-shaped tubercle (Fig. 11f) oriented to the caudal margin that is longer than that of any of the other known species.

**Description. Puparium habitus.** Measurements in microns ( $\mu\text{m}$ ) were taken from 6 specimens from the USNHM. **Slide mounted puparium.** Body elongate and widest between abdominal segments 1 and 2 with puparium (Fig. 11a) 1336-1484 [1399] long by 822-935 [860] wide; holotype 1370 long by 8221 wide.

**Dorsal pigmentation.** Radially concentric solid band of brown pigmentation that is consistent for all six specimens from basal margin of teeth joined without interruption from the anterior margin of the cephalon to below the vasiform orifice extending mesially to and terminating before the compound pores (Fig. 1e, 11a); paired subdorsal stippled patches present enclosing each compound pore and reduced pair of patches from A5 to A8 enclosing clusters of minute simple pores (Fig. 11d). Longitudinal suture extends from the anterior margin terminating at the transverse suture, which overlaps half of the first segment of the T3 leg. A1 to A8 sutures present and each associated with a pair of shallow submedian depressions.

**Margin.** Row of apically rounded marginal teeth, subequal in width, and separated; basal area of teeth forming a tooth-like narrow collar (Fig. 11c, g); teeth vary from 5 to 14  $\mu\text{m}$  wide with the narrowest width of the apical marginal teeth (5-6 teeth) across from the C1 compound pore (Fig. 11e), posterior to the PMS, and the caudal margin each with 4-6 reduced teeth (Fig. 11c). Puparial margin smooth at 40x with striations from the margin to the outer set of marginal teeth and a 2 to 3 pronged fork arising between each outer tooth.

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 11a); each compound pore surrounded by a stippled area (Fig. 11b); central lumen consists of a clear center with an outer annulus (ring of cells) with larger cells and an inner ring with smaller cells surrounding the central process; CP1 compound pore diameter: 39- 50 [45] with the holotype: 44 and 47; CP2 diameter: 57 to 73 [66] with the holotype: 57 and 65; and CP3 diameter: 53 and 68 [62] with the holotype: 53 and 53. Central process (when present) is cone shaped (Fig. 11b) and elongated, light brown, with faint longitudinal striations extending well beyond the rim of the pore; with the following lengths from the central lumen to the apex: CP1 central process length: 64-80 [70] long with the holotype: 64 (other broken off); CP2: 77-120 [97] with the holotype: 76 and 94, and CP3: 97-116 [103] and the holotype: 97 and 98. Minute dorsal loculate pores (Fig. 11c) distributed from the submargin to the median and from the cephalon to below the vasiform orifice and forming a submarginal row at the base of the inner row of teeth between 2 to 4 teeth intervals; diameters of loculate pores range from 4.4 to 6.1 [5.2]. Simple disc pores of various sizes distributed on the dorsum including the glandular areas of the compound pores.

**Chaetotaxy.** Marginal, subdorsal, and submedian and ventral setae present (Fig. 11d, h). Subdorsal and submedian setae with a pigmented pinaculum that is twice as wide in diameter as the diameter of the setal base. Anterior and posterior marginal setae present with AMS 16-32 [22] long with the holotype 16 and 22; the PMS 35-47 [41] long with the holotype 42 and 43 (Fig. 11d); dorsal submedian setae (ASMeS and PSMeS) present on segments C1 (close to the submargin), C2 (anterior and lateral margin of the rostrum), T1, T2, T3 and A8, measuring in length: ASMeS(C1) 14-26 [21] with the holotype 26 and the other broken off, ASMeS(C2) 17-25 [20] with the holotype 19 and 25, ASMeS(T1) 13 and 26 [20] with the holotype 13 and 13, ASMeS(T2) 22-29 [26] with the holotype 27

and 27, ASMeS(T3) 20-26 [24] with the holotype 25 and the other setae broken, PSMs(A8) 24-46 [37] with the holotype 34 and 41 (Fig. 11f); CS present at the base of the inner teeth 26-50 [40] with the holotype 38 and 38. 11-12 ASDS (19 setal lengths sampled) and 12-14 PSDS subdorsal row of setae (with 23 setal lengths sampled) were measured: ASDS 14-34 [28] and PSDS 30-54 [41] long with the holotype setae: 20, 24, 26, 26, 27, 28, 29, 32 and 32 long; the PSDS measured 30-48 long and the holotype: 30, 33, 35, 38, 40, 40, 40, 41, 42, 42, 43 and 47; ventral AVS(T2) 15-30 [23] with holotype 21 and 30, AVS(T3) 16-26 [22] with holotype 22 and 24, PVS(A8) absent, and PVS(VO) 32-43 [38] present (on the margin of the vasiform orifice).

**Vasiform orifice.** Cordate in shape (Fig. 11d, f); 117-134 [124] long and 103-112 [107] wide and the holotype 116 long by 103 wide; operculum rectangular with a uniform rounded posterior margin and marked with a narrow spinulose U-shaped band and a medial granular pattern, 70-75 long [73] long and 87-104 [94] wide with the holotype being 73 long by 87 wide (Fig. 11d); lingula spatulate (longer than wide) and spinulose 82-95 [88] long by 50-68 [57] wide with the holotype 82 long by 50 wide; tubercle present on posterior border of orifice with the base oval shape and with an extended rectangular projection apically fringed (Fig. 11) and extending into the abdomen (shaft missing in one specimen): 24-29 [25] long and 6-11 [7] wide. Distance from posterior margin of vasiform orifice to the margin between the caudal setae is 135-149 [141] with the holotype 136.

**Venter.** Antennae long extending to lateral of the T2 legs. Forelegs oriented toward the anterior margin and the middle and hind legs oriented toward the posterior margin. Legs terminating in a claw with a long seta associated at the midpoint basal margin of each T2 and T3 legs and a pair of smaller setae at the anterior basal margin. Ventral submarginal and subdorsal subcircular hyaline tubercles (Fig. 11d) present with internal striae distributed within framework of dorsal pigmented band.

**Description. Nymph habitus** (Stage 3). *Slide mounted nymph.* Measurements in microns ( $\mu\text{m}$ ) were taken from three nymphs from the USNHM. Pale, elongate and widest between abdominal segments 1 and 2, 1007-1074 [1049] long by 582-648 [624] wide (Fig. 12a). Longitudinal suture faint extending from the anterior margin terminating at the transverse suture, which overlaps half of the first segment of the T3 leg. A1 to A8 sutures present and each associated with a pair of shallow to faint submedian granulated depressions.

**Margin.** Finely dentate without a row of defined marginal teeth; submargin with irregular, faint striations (Fig. 12c, e) oriented mesially.

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 12a); each compound pore surrounded by a smooth glandular area; central lumen consists of a clear center with an outer annulus (ring of cells) with larger cells and an inner ring with smaller cells; CP1 compound pore diameter: 33-41 [37]; CP2 pore diameter: 48-65 [58]; and CP4 diameter: 53-58 [55]. Central processes absent. Minute dorsal loculate pores scarcely distributed from the submargin to the median and from the cephalon to below the vasiform orifice; diameters of loculate pores range from 3-5 [4] from measuring diameters of 9 pores. Simple disc pores distributed sparsely on the dorsum but increasing in numbers within the subdorsal glandular areas including those enclosing the compound pores.

**Chaetotaxy.** Marginal, dorsal, subdorsal, submedian, and ventral setae present (Fig. 12a, c, e). Anterior and posterior marginal setae present with AMS 11-22 [16] long (Fig. 12b); the PMS 29-42 [36] long (Fig. 12c); dorsal submedian setae (ASMeS and PSMs) present on segments (Fig. 11b, c, e) with C1 (close to the anterior submargin), C2 (anterior and lateral margin of the rostrum), T1, T2, T3 and A8, measuring in length: ASMeS(C1) 12.4-22.8 [19], ASMeS(C2) 9.6- 18 [15], ASMeS(T1) 11-21.8 [19], ASMeS(T2) 13-25.6 [17], ASMeS(T3) 15-28 [19], PSMs(A8) 20-42 [28]; CS present at the base of the inner teeth 29-31 [30]. 12-13 ASDS (from 27 sampled setal lengths) and 12-14 PSDS (from 20 sampled setal lengths) subdorsal rows of setae were measured: ASDS length ranging from 12-32.8 [24] and PSDS length ranging from 5-52 [30]. AVS(T2) 8-22 [14], AVS(T3) 10-11 [11], PVS(A8) 26-41 [35], PVS(VO) (on the submedian of vasiform orifice ventrad of the operculum) 17-43 [27].

**Vasiform orifice.** Cordate in shape; 94-113 [104] long and 87-127 [104] wide (Fig. 12c); operculum 51-52 long [51] long and 83-92 [88] wide, with a uniform rounded lateral to posterior margin and a defined straight anterior margin, marked with a narrow spinulose U-shaped band and a smooth anterior median area (Fig. 12c); lingula spatulate (longer than wide) and spinulose 66-71 [69] long by

49-75 [62] wide; tubercle present on posterior border of orifice with the flap like to elongate 21-30 [26] long by 6-20 [12] wide extending into the abdominal segment (Fig. 12e). Distance from posterior margin of vasiform orifice to the margin between the caudal setae is 74-86 [81].

**Venter.** Antennae 2-segmented, short, about 29-35 [32] long with last segment bent at a 90 degree angle in all specimens (Fig. 12b). T1 legs oriented toward the anterior margin and the T2 and T3 legs oriented toward the posterior margin; each with a terminal claw, with one seta at the base of the first segment.

**Description. Nymph habitus (Stage 2). Slide mounted.** Measurements in microns ( $\mu\text{m}$ ) were taken from nine specimens from the USNHM. Pale, 721-1022 [979] long by 412-640 [599] wide; elongate and widest between abdominal segments 1 and 2 (Fig. 12a). Longitudinal suture absent; transverse suture, which overlaps half of the second segment of the T3 leg. A1 to A8 sutures present and each associated with a pair of shallow to faint submedian fringed depressions.

**Margin.** Finely dentate without a row of poorly defined marginal teeth.

**Pores.** Compound pores and central processes absent. Minute dorsal loculate pores distributed in both submarginal and submedian row; diameters of loculate pores range from 3-55 [3.7] from measuring diameters of 13 pores. Simple disc pores distributed sparsely on the dorsum.

**Chaetotaxy.** Marginal, subdorsal, dorsal submedian, and ventral setae present (Fig. 12g-h). Subdorsal and submedian setae with a pigmented. Anterior and posterior marginal setae present with AMS 9-16 [13] long; the PMS 24-38 [31] long; dorsal submedian setae (ASMeS and PSMes) present on segments with C1 (close to the anterior submargin), C2 (anterior and lateral margin of the rostrum), T1, T2, T3 and A8, measuring in length: ASMeS(C1) 11-17 [13], ASMeS(C2) 3-13 [10], ASMeS(T1) 5-13 [9], ASMeS(T2) 8-16 [13], ASMeS(T3) 7-17 [11], PSMes(A8) 16-27 [21]; 12-16 ASDS with 74 setae sampled and 12 PSDS subdorsal row of setae with 63 setae sampled: ASDS length ranging from 5-25 [20] and PSDS length ranging from 4-36; PVS(A8) absent, PVS(VO) present (on the submedian anterior ventral floor of vasiform orifice directly below the operculum) 16-31 [25]; CS present at the base of the inner teeth 18-35 [27].

**Vasiform orifice.** Cordate in shape; measured 82-104 [98] long and 75-98 [91] wide with posterior floor of vasiform orifice reticulated; operculum 35-53 long [48] long and 72-90 [84] wide, with a uniform rounded lateral to posterior margin and a defined straight anterior margin, marked with a narrow spinulose U-shaped band and a smooth anterior median area (Fig. 12c); lingula spatulate (longer than wide) and spinulose 56-75 [69] long by 38-56 [50] wide; tubercle present on posterior border of orifice with the flap like 5-15 [10] long by 7-18 [12] wide extending into the abdominal segment (Fig. 12c). Distance from posterior margin of vasiform orifice to the margin between the caudal setae is 30-82[71].

**Venter.** Antennae 2 segmented, short, about 13-40 [29] long with last segment bent at a 90 degrees angle in all specimens. Legs terminating in a hook. Legs 3-segmented and oriented toward lateral margins, basal segment of each leg with long setae (Fig. 12g).

**Description. Adult female.** Measurements in microns ( $\mu\text{m}$ ) were taken from one specimen from the USNHM. **Slide mounted specimen.** Adult measurement at 5x power of the dissecting scope (Fig. 13a): length 1017 by 1033 from the cephalic vertex to the apical end of the ovipositor with the widest point at A1.

**Cephalon.** Angular and slightly rounded at the vertex (Fig. 13b). Antennae 7-segmented with segments 3 to 7 annulated and with rows of microtrichia. Antennal segment 1 spinulose 44 long by 48; segment 2: 114 long by 50 wide, spinulose without sensory spots, 3 long lateral setae measuring 15 to 22 long; segment 3: 318 long by 24 wide with one basal, one median, and 2 apical sensory pits; segment 4: 211 long by 10 wide with one subapical sensory pit; segment 5: 114 long by 13 wide with 1 subapical and 1 apical sensory pit; segment 6: 76 long and 15; and segment 7 from the terminal point to base 81 long by 16 wide. Other antenna only with segments 1 and 2 present. Distance from the vertex to the posterior margin of the cephalon is 214 and transverse distance between the innermost points of the compound eyes is 190. A pair of ocelli (Fig. 13b) proximal to the anterior inner margin of each compound eye 31 and 34 long. Upper and lower hemisphere of each compound eye connected by 4 ommatidia with each eye widely separated. From the vertex to posterior margin of head and between



ocelli and compound eyes are dorsal and ventral transverse rows of small spinules; between these spinulose rows and the ocular areas is a pair of longitudinal rows of setae with varying lengths (Fig. 13b). Venter of cephalon between ocular areas with many setae varying in length to longer than the diameter of each ocellus (Fig. 14c). From the vertex to the basal antennal segments is a row of setae.

**Thorax.** T1 spiracle oval, 310 in diameter; others distorted, unable to measure. T1 with setae of varying lengths abundant on the anterior. T2 and T3 dorsum with rows of spinules. Three pairs of legs terminating in two curved claws and a long, slender and acute paronychium present on the basal segment of the claw. Femurs and trochanters with a row of 2-3 irregularly shaped large pores basally; tibia on leg 1 with an irregular row of setae from 1 to 2 rows apically. Tibia on leg 2 with two lateral pairs of tibial brushes one with five setae and the other with three setae (Fig. 13d). Metatibia with a comb of two rows of setae and 1 brush with 5 setae (Fig. 13e).

**Abdomen.** Four pairs of ventral wax plates (Fig. 14a). A3 to A7 tergites lightly pigmented (light brown) medio-dorsally; A1 to A8 tergites with rows of microtrichia medially and a pair of setae (Fig. 13f).

**Vasiform orifice.** Orifice slightly cordate with operculum truncate with dorsum spinulose, 75 long by 86 wide; spatulate lingula 768 long by 37 wide. Ovipositor apparatus consists of gonophyses, ovipositor and valvifers (Fig. 13g-i); terminating in two long acute blades with a pair of long setae and gonopophysis; unpaired gonopophysis granulated on floor (Fig. 14g) and spinulose with ribbon-like structure above on opposite face (Fig. 13h).

**Description. Adult male.** Measurements were taken from one specimen from the USNM. **Slide mounted specimen.** Adult measurement at 5x power of the dissecting scope: length 1409 by 235 from the cephalic vertex to the apical end of the claspers with the widest point at A1 (Fig. 14a).

**Cephalon.** Slightly rounded at the vertex (Fig. 14h). Antennae broken with only segments 1 through 3 intact with segments 3 annulated. Antennal segment 1 spinulose 30 long by 42 wide; segment 2: 910 long by 49 wide, spinulose with two basal sensory spots; and segment 3: 73 long by 25 wide. Dorsal distance from the vertex to the posterior margin of the cephalon is 195 and transverse distance between the innermost points of each compound eye is 179. A pair of ocelli proximal to the anterior inner margin of each compound eye 29 long (Fig. 14h). Upper and lower hemisphere of each compound eye connected by four ommatidia with each eye widely separated. From vertex to posterior margin of head and between ocelli and compound eyes are dorsal transverse rows of small spinules (Fig. 14h); between these spinulose rows and the ocular areas is a pair of longitudinal row of setae with varying lengths no longer than the diameter of the associated ocellus. Venter of cephalon between ocular areas with many setae varying in length to longer than the diameter of each ocellus (Fig. 14i). Cephalon with a ventral row of setae between the basal antennal segments.

**Thorax.** Dorsum with setae of varying lengths with minute setae appearing as rows of spinules. Three pairs of legs terminating in two curved claws and a long, slender and acute paronychium present on the basal segment of the claw. Femurs and trochanters with a row of 2-3 irregularly shaped large pores basally; T1 tibia with an irregular row of setae from one to two rows apically. Mesotibial leg with a lateral pair of tibial brushes each with 4 setae (Fig. 14f). Tibia of Leg 3 with a comb of two rows of setae and 1 brush with 4 setae (Fig. 14e).

**Abdomen.** Three pairs of ventral wax plates. A3 to A7 tergites pigmented medio-dorsally; A3 to A7 tergites transversely striate; and A3 to A6 pigmented areas of tergites with clusters of discoidal pores. A9 tubular-shaped, 616 long by 318 wide being 2 times longer than wide (Fig. 14c).

**Vasiform orifice.** Orifice slightly cordate with transverse operculum truncate at posterior margin spatulate lingula 74 long by 31 wide; a pair of curved claspers from 549 long with an acute apex and a row of small setae on the dorsal and ventral surface; aedeagus curved 266 long and slightly inflated about 1/3 the length from the base.

**Description. Adult wings** (Fig. 15a-d). Since the wings were detached and cannot determine gender, description will be based on two pairs of front and hind wings that are mounted separately. Descriptions were recorded from two pairs of forewings and hind wings. Wings with forked radial vein, R1 and Rs, and cubitus vein (Cu) present in all wings. Large to small diffuse spotting (pigmented maculations) occurs on all wings. Wings 1a and 1b lacking a complete apical and subapical band from R to costal

margin; wings measure 1757 and 1745 long with a row of ten acute basal marginal setae on the costal vein (C); eight to nine pigmented maculations per wing; one elongated and broad anterior maculation at costa midpoint to  $\frac{1}{2}$  the distance before R1 and Rs fork, 3 to 4 maculations between R1 and Rs veins, 4 maculations from midvein to apical margin between Rs and cu vein, and largest maculation between basal margin of Cu and the posterior margin of wing. Wings 2a and 2b measure 2055 and 2099 long; 12 pigmented maculations per wing from 30 to 40 long, with a complete broad apical band (longest diffused maculation) from the anterior apical margin extending midway between the R1 and Rs forked veins; additional maculation between Rs and R1 veins adjacent to fork; two anterior maculations from anterior costa vein anterior and posterior to radius forked junction terminating half way to radius and R1; 4 maculations present between R/Rs and Cu veins: one basal, one apical and two midpoint; 4 maculations between Cu and posterior margin. Wing 3a and wing 3b measure 1953 and 1593 long; 8 pigmented maculations per wing; one maculation between the costa and the radius terminating before the forked juncture; two between the R1 and Rs veins; three between the Rs and Cu veins; and two below the Cu vein, one basally and one apically. Wings 4a and 4b measure 1976 and 2032 long; 12 pigmented maculations per wing from 757 to 763 long, with a complete broad apical band (longest diffused maculation) from the anterior apical margin extending midway between the R1 and Rs forked veins; two anterior maculation from anterior costa vein anterior and posterior to radius forked junction terminating half way to radius and R1; four maculations present between R/Rs and Cu veins: one basal, one apical and two midpoint; four maculations between Cu and posterior margin.

**Etymology.** Named after Honduras, the country in which it was collected in 1948.

**Distribution.** Neotropical: Honduras, El Zamorano.

**Host.** Unknown leaf.

**Material examined.** Holotype (puparium). El Zamorano, Honduras Collected by T. H. Hubbell; #59 48-1389, deposited at the USNHM. Paratypes (5 puparia, 1 slide). Same data as on holotype. Adult male and female (1 each on slide). Stage 3 nymphs (3 nymphs, 1 slide); stage 2 nymphs (8 nymphs, 1 slide), deposited at the USNHM

**Comments.** Known only from Honduras on an indeterminate host.

***Bakerius leei*** Dooley and Smith-Pardo sp. nov.  
(Fig. 16)

**Diagnosis.** Pigmented pattern uniform (Fig. 16a) for all specimens observed differing from all other known pigmented species by having a V-shaped pale areas medially from A1 to A8 and a pigmented area that is rounded on the anterior cephalic region and forming an acute angle on the posterior margin enclosing all compound pores; with large to small dorsal tessellations especially posterior to and lateral of the vasiform orifice.

**Description. *Puparium habitus.*** Shape and coloration in vivo unknown. Measurements in microns ( $\mu\text{m}$ ) were taken from 3 specimens from the USNHM. ***Slide mounted puparium.*** Body ovoid (Fig. 16a), 1982-2046 [2020] long by 1440-1478 [1458] wide; holotype 1982 long by 1440 wide.

***Dorsal pigmentation.*** Brown pigmentation from subdorsum to median, from cephalon to cauda enclosing the compound pores, with a pale V-shaped abdominal area from submedian to median of A1 to A8, and the pigmented band below the vasiform orifice converging before margin (Fig. 16a); cuticle tessellated on subdorsum from cephalon to posterior of vasiform orifice (Fig. 16f), on submedian to median anterior to rostrum and vasiform orifice.

***Margin.*** Row of apically round marginal teeth, subequal in width, and separated; basal area of teeth forming a narrow collar. Puparial margin finely serrate to smooth at 40x with striations from the margin to the outer set of marginal teeth (Fig. 16d).



**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 16a) with the following diameters (Fig. 16a, c): CP1 compound pore diameter: 54-63 [59] and the holotype 57 and 59, CP2: 67-78 [71] and the holotype: 68 and 70, and CP3: 66-80 [72] and the holotype 70 and 80. Central process (when present) cone shaped, light brown, with faint longitudinal striations, extending two or more times its length from the rim of the pore as opposed to the length from the central lumen to the rim (Fig. 16e); with the following lengths from the central lumen to the apex: CP1 central process: 89-108 [98] and the holotype 89 and 105, CP2 process: 121-132 [125] and the holotype 122 and 124, and CP3 process: 103-123 [113] and the holotype: 117 and 122; central lumen consists of an outer annulus (ring of cells) with larger cells and an inner ring with smaller cells. Minute loculate pores (Fig. 16e) scarce and if present only at the base of the teeth and a few in the submedian cephalothorax; simple disc pores of various sizes distributed on the dorsum not closely associated with compound pore (Fig. 16a, e). Reticulated floor of vasiform orifice with 6-8 simple disc pores.

**Chaetotaxy.** AMS 32-43 [36] long with the holotype 32 and 43 long and the PMS 48-64 [52] long with the holotype 48 and the other broken off (Fig. 16b, f); dorsal submedian setae (ASMeS and PSMeS) present on segments C1, C2, T1, T2, T3 and A8 (Fig. 16b, c), measuring in length: ASMeS(C1) 19-35 [22] with the holotype 102 and 110, ASMeS(C2) 15-28 [20] with the holotype 17 and 18, ASMeS(T1) 15-21 [17] with the holotype 19 and 21, ASMeS(T2) 11-20 [15] with the holotype 15 and 20, ASMeS(T3) 19-27 [22] with the holotype 23 and the other one missing, PSMeS(A8) 27-49 [38] with the holotype 27 and the other missing; AVS(T2) 22-26 [24] and the holotype 26 long and other seta missing, AVS(T3) 21-31 [26] and the holotype 27 and the other seta missing (Fig. 16c), PVS(A8) absent, PVS(VO) 46-68 [54] on the lateral border of vasiform orifice about midway from anterior margin to base broken off in the holotype (Fig. 16c); CS present 13-28 [21] with the holotype 13 long and the other missing; 10-12 cephalothoracic and 12 abdominal submarginal row of setae present: ASDS.10-29 [17] and PSDS 11-40 [22] long.

**Vasiform orifice.** Subcordate in shape (Fig. 16a, g), 131-141 [136] long and 106-118 [113] and the holotype 131 long by 106 wide with posterior floor of vasiform orifice reticulated and disc pores visible through the lingula; operculum rectangular, 75-94 [82] long and 95-146 [114] with the holotype being 94 long by 147 wide with rounded lateral margins, a bisinuate posterior margin and marked with a spinulose U-shaped band (Fig. 16g); lingula conical 75-89 [81] long by 62-76 [65] wide with the holotype 78 long by 62 wide; tubercle present on posterior border of orifice. Distance from posterior margin of vasiform orifice is 243-258 [253] with the holotype 258.

**Etymology.** Named after Kat M. Lee, the quarantine officer who intercepted the pest.

**Distribution.** Neotropical: Ecuador (intercepted in quarantine at Jamaica, New York, USA).

**Host.** Rutaceae: *Citrus* sp.

**Material examined.** Holotype. Puparium intercepted on *Citrus* sp. (from Ecuador in passenger baggage at Jamaica, New York Port of entry), on 18-ii-2011, K. Lee, deposited at the USNHM (slide# apnny110494909001a). Paratypes: 2 puparia (2 slides) intercepted on *Citrus* sp. (from Ecuador in passenger baggage at Jamaica, New York Port of entry), on 18-ii-2011, K. Lee, deposited at the USNHM (slide# apnny110494909001b and apnny110494909001c).

**Comments.** This is the only *Bakerius* species known to occur on *Citrus* sp. Since these specimens were intercepted in quarantine at JFK International Airport arriving in passenger baggage from Honduras, the true origin of the species is uncertain.

***Bakerius marmoratus* Hempel 1923**

**Description** (English translation of Hempel 1923). **Puparium habitus.** Puparium broadly oval, 1570 µm long by 1000 wide, pale with central area darker and abdominal segments distinct. True margin minutely crenulate with two rows of much larger crenulations. Vasiform orifice is large,

subpyriform, being widest across the anterior part. Operculum small, transversely rectangular, with lateral margins rounded, and does not reach to half the length of the orifice. Lingula is large, thick and spatulate hardly reaching the posterior margin of the of the vasiform orifice.

**Distribution.** Neotropical: Brazil.

**Host.** *Baccharis genistelloides* (Lam.) Pers. (Asteraceae)

**Material examined.** No specimen or illustration available.

**Comments.** This species was cited in Hempel (1923) as having two full rows of fully developed “crenulations” close to the finely crenulated margin. All other species have one full row of fully developed teeth except for the pale species *B. glandulosus*.

***Bakerius peruvianus*** Dooley and Smith-Pardo sp. nov.  
(Fig. 17-19)

**Diagnosis.** Puparium of *B. peruvianus* differs from other *Bakerius* species by the following combination of characters: body elongate, tapering toward the cephalic and caudal margins with marginal teeth reduced in width at the tracheal margin and the margin directly posterior to the PMS. Brown pigmentation surrounding the rostrum from the median to the subdorsum with pale area surrounding the cephalic compound pores; thoracic segments with brown bands from the median to the inner base of the legs and fading into the submargin; A1 and A2 each with brown median to submedian band gradually fading toward the submargin; each abdominal compound pore surrounded by a pale area; A3 to A6 with median brown patch extending beyond outer margin of compound pore pale area fading to the submargin and alternating with a narrow subdorsum to submargin pale bands; A7 and A8 with a median to submedian pigmented band surrounding the vasiform orifice and extending to the posterior caudal margin. *Bakerius peruvianus* differs from *B. asiaticus* by its pigmented pattern, by the central processes being fimbriate, from Peru, and the only species feeding on ferns; whereas *B. asiaticus* is differently pigmented (see description), the central processes are apically acute, and is only known from Vietnam.

**Description. Puparium habitus.** Shape and coloration in vivo unknown. Measurements in microns (µm) were taken from nine of 13 puparia examined (USNHM). **Slide mounted puparium.** Body elongate (longer than wide with anterior and posterior apical margins tapering into an acute angle (Fig. 19a). Puparium 1605-1704 [1654] long by 988-1086 [1038] wide with the holotype 1660 long by 1050 wide.

**Dorsal pigmentation.** Brown pigmented patches: lighter brown patches surrounding the rostrum from the median to the subdorsum with pale area surrounding the cephalic compound pores; thoracic segments with brown bands from the median to the inner base of the legs and fading into the submargin; A1 and A2 each with brown median to submedian band gradually fading toward the submargin; each abdominal compound pore surrounded by a pale area; A3 to A6 with median brown patch extending beyond outer margin of compound pore pale area fading to the submargin and alternating with a narrow subdorsum to submargin pale bands; A7 and A8 with a median to submedian pigmented band surrounding the vasiform orifice and extending to the posterior caudal margin (Fig. 1g, 19a). Cuticle smooth except for subdorsal or submarginal lightly tessellated patches.

**Margin.** Smooth (Fig. 19b, d) with a row of apically rounded teeth, subequal in width; basal area of teeth forming a narrow collar (Fig. 19b); 6-8 [7] teeth are found within 100 µm. Each tooth apically rounded with lateral borders of the teeth varying from 5 to 21 µm wide, the narrowest width of the marginal teeth is across from the C1 compound pore and posterior to the PMS (Fig. 19b); marginal teeth with 2-3 prong structures arising from between the teeth and extending to the margin (best seen at 40x phase contrast).

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 19a). Central lumen consisting of a clear center, outer narrow annulus (ring of cells) with larger cells and a narrow inner annulus with smaller cells. CP1 compound pores: 38-45 [42] in diameter and the holotype 42 and 44, CP2: 44-61 [54] and the holotype: 54 and 56, and CP3: 44-55 [49] and the holotype: 51 and 55. Central process (when not missing or broken) is a light brown (Fig. 19f), elongated cone extending well beyond the rim of the pore, with faint longitudinal striations, and apically fimbriate. CP1 central process: 67-84 [80] long and the holotype: 80-84; CP2 central process: 78-104 [94] and the holotype: 95 and 93, and CP3: 83-101 [96] and the holotype: 102 and 104. Minute dorsal loculate pores (Fig. 19h) with a bright center (with a ring of faint 4-5 locules) ranged in diameter 5-7 (measuring 17 pores) with the holotype 6, most numerous around the vasiform orifice and distributed throughout the cuticle and along the basal row of teeth; simple disc pores of various sizes (not closely associated with compound pore) distributed on the dorsum from solitary to clusters of 2-3 more numerous around the vasiform orifice (Fig. 19i). Pores within the cluster are separated no more than 2× their distance from each other in relation to their diameter.

**Chaetotaxy.** Marginal, subdorsal, and submedian setae present (Fig. 19d, e, g). Anterior and posterior marginal setae present (Fig. 19d, g) with AMS 11-43 [35] long with the holotype 43 and 43, and the PMS 32-66 [54] long with the holotype 53 and 62; dorsal submedian setae (ASMeS and PSMeS) present (Fig. 19d, c, g) on segments C1 (close to the submargin), C2 (anterior and lateral margin of the rostrum), T1, T2, T3 and A8 (Fig. 19e). ASMeS(C1) 14-30 [23] with the holotype 14 and 15, ASMeS(C2) 17-30 [22] with the holotype 23 and 28, ASMeS(T1) 22-32 [26] with the holotype 30 and the other seta missing, ASMeS(T2) 22-37 [27] with the holotype 32 and the other seta missing, ASMeS(T3) 26-37 [31] with the holotype 32 and 34 ((Fig. 19d); PSMeS(A8) 34-46 [37] long with the holotype 36 and 41 (Fig. 19e); AVS(T2) 31-51 [41] and holotype: 45 and 46, AVS(T3) 39-56 [51] and the holotype: 32 and 34, PVS(A8) absent, PVS(VO) 51-88 [71] on the submedian of vasiform orifice ventrad of the operculum with the holotype 76 and 88 (Fig. 19i); and the CS present at the base of the inner teeth 19-40 [34] with the holotype 35 and 39; 11-12 ASDS with 69 setal lengths measured and 13-14 PSDS subdorsal row of setae with 68 setal lengths measured: ASDS 11-38 [23] and PSDS 21-43 [35] long; the holotype with the ASDS setae measured 19-31 long and the PSDS measured 27-40 long (Fig. 19g).

**Vasiform orifice.** Cordate in shape (Fig. 19i); measured 106-123 [116] long and 89-99 [95] wide with the holotype 123 long and 99 wide. Operculum rectangular with a uniform rounded lateral margins and marked with a narrow spinulose U-shaped band and an anterior median half with a faintly corrugated pattern (Fig. 19h, i), 50-57 long [54] long and 78-94 [85] wide with the holotype being 57 long by 86 wide; lingula spatulate (slightly longer than wide) and spinulose 64-71 [68] long by 50-63 [57] wide with the holotype 68 long by 510 wide; tubercle small and oval in several specimens. Distance from posterior margin of vasiform orifice to the margin between the caudal setae is 236-262 [247] with the holotype 239.

**Venter.** Antennae long, annulated on the distal 2/3 of its length. Legs appear 3-segmented with forelegs oriented toward anterior margin and T2 and T3 oriented toward posterior margins. Apical tarsal segment of legs 2 and 3 with a pair of setae at midpoint.

**Description. Adult female** (Fig. 17). Measurements in microns (µm) were taken from one specimen from the USNHM. **Slide mounted specimen.** Adult measurement at 10x power of the compound microscope: length 1935 long by 790 wide from the cephalic vertex to the apical end of the ovipositor with the widest point at A1.

**Cephalon.** Slightly rounded at the vertex (Fig. 17d). Antennae 7-segmented with segments 3 to 7 annulated and with rows of microtrichia. Antennal segment 1 spinulose 54 long by 44; segment 2: 116 long by 47 wide, spinulose without sensory spots; segment 3: 281 long by 29 wide with one basal sensory pit; segment 4: 131 long by 17 wide without sensory pit; segment 5: 117 long by 17 wide with 1 apical sensory pit; segment 6: 69 long and 17 without observing any sensory pit; and segment 7 from the terminal point to base 75.9 long by 21 wide with one apical sensory pit. Distance from the vertex to the posterior margin of the cephalon is 176 and transverse distance between the innermost points of the compound eyes is 145. A pair of ocelli (Fig. 17b) proximal to the anterior inner margin of each compound eye: 20 and 21 in diameter. Compound eyes widely separated. From vertex to posterior margin of head and between ocelli and compound eyes are dorsal (Fig. 17b) and ventral (Fig. 17c)

transverse rows of small spinules; between these spinulose rows and the ocular areas is a pair of longitudinal row of setae with varying lengths. Venter of cephalon between ocular areas with many setae varying in length to longer than the diameter of each ocellus. Three pairs of setae from the basal antennal segments to the vertex.

**Thorax.** T1 with setae of varying lengths abundant on the anterior margin and with rows of spinules (Fig. 17d). Three pairs of legs terminating in two curved claws and a long, slender and acute paronychium present on the basal segment of the claw. Femurs and trochanters with a row of 2-3 irregularly shaped large pores basally; tibia on leg T1 with an irregular row of setae from 1 to 2 rows apically. Tibia on leg T2 with two lateral pairs of tibial brushes one with 4-5 setae and the other with four setae, tibia of leg T3 with a comb of two rows of setae and 1 brush with four setae (Fig. 17e).

**Wings.** One pair of forewings and one pair of hind wings present. Wings with costa/subcosta, radius, forked radial veins (R1 and Rs), and cubitus vein (Cu) present; large to small diffuse spotting (pigmented maculations) present on all wings. Fore wings (Fig. 18a-b): 1845 long and 1470 at the widest; lacking a complete apical and subapical band from R to costal margin; 14-16 pigmented maculations from spots to larger diffused maculations per wing; 4-5 maculations between costa and radius, two maculations between radius and cubitus, 2-3 maculations between cubitus and wing margin with apical maculation joined to apical end of cubitus, one long maculation between cubitus and R1, 4-5 maculations between R1 and Rs with the larger extending to the costa. Hind wing (Fig. 18d): 1748 long and 1158 at the widest; lacking a complete apical and subapical band from R to costal margin; 10-11 pigmented maculations per wing from; two maculations between costa and radius, two maculations between radius and Cu, three maculations between Cu and wing margin, one maculation between Cu and R1, three maculations between R1 and Rs.

**Abdomen.** Four pairs of ventral wax plates (Fig. 17a) A3 to A7 tergites lightly pigmented (light brown) medio-dorsally (Fig. 17a); A1 to A8 tergites with rows of microtrichia medially and a pair of setae (Fig. 17j).

**Vasiform orifice** (Fig. 17i). Orifice slightly cordate with operculum truncate with dorsum spinulose and posterior margin slightly bisinuate, 67 long by 92 wide; spatulate lingula 74 long by 55 wide (Fig. 17i). Ovipositor apparatus consists of gonophyses, ovipositor and valvifers (Fig. 17h) with ovipositor terminating in two long acute blades with a pair of long setae.

**Etymology.** Named after the country in which it was collected (Peru) in 1961.

**Distribution.** Neotropical: Peru.

**Host.** “Gamakotya” (fern).

**Material examined.** Holotype (puparium). On “Gamakotya” (fern) from Peru. Collected by E. W. Van Heurn. October 24, 1961. T-8, deposited at the USNHM. Paratypes (12 puparia, 5 slides). Same data as on holotype. Adult female (1 each on slide). Same data as on holotype, deposited at the USNHM.

**Comments.** *Bakerius peruvianus* differs from *B. asiaticus* by the pigmented pattern being more extensive extending to the submargin and because the central processes are fimbriate, not acute; whereas in the latter the pigmented pattern being mostly on the submedian and median areas and the central processes being apically acute; *Bakerius peruvianus* is only known from Vietnam whereas *Bakerius peruvianus* is known only from Peru.

***Bakerius phrygilanthi* Bondar 1923**  
(Fig. 20)

**Description** (based on translation from Bondar 1923). *Puparium habitus.* Observed with the lens, when on the leaf, appears with a brown pigmented dorsum, with light covering of wax secretions the margin with a narrow white fringe. Dorsum arises perpendicular in height of about 800 to 1200 µm. Three pairs of white cylindrical pores with a cephalic pair and two abdominal pairs. Nymphs



accumulate on the entire leaf forming a dense white coat. This is characteristic. Under the microscope devoid of wax, appearing yellow with a brown-pigmented dorsum. The pupal case is elongated and elliptical being 1558  $\mu\text{m}$ . in length, about 1016  $\mu\text{m}$ . wide; the posterior is rounded, dorsum with three pairs of large compound pores; a cephalothoracic pair and two pairs considerably larger, on the second and fourth abdominal segments. Each pore consists of a central brown pore, considerably high, surrounded with cells, in turn, surrounded by two rows of rounded blades; all pores are 57  $\mu\text{m}$  in diameter. Agglomerate pores absent. The entire margin smooth; with two complete rows of teeth. The dark dorsal pigmentation forms an acute angle at the cephalothorax, extending to the abdomen, with a dark band inclosing the abdominal pores and narrows again enclosing the vasiform orifice. In the dark area are numerous clear, minute disc pores; simple wax-producing glands that produce powdery white wax. The vasiform orifice is elongated and reticulated on the bottom half; the operculum is pigmented brown with the posterior margin bisinuate; lingula included, large, and spatulate (Bondar 1923). **Slide mounted puparium.** Measurements in microns ( $\mu\text{m}$ ) were taken from two fair specimens of 4 puparia loaned from the USNHM. Body elongate, longer than wide with anterior and posterior apical margins tapering into an acute angle.

**Dorsal pigmentation.** Pupal case with brown pigmented spindle-shaped patch tapering from the cephalon (enclosing only the abdominal compound pores) to below the vasiform orifice from the subdorsum to the median at its widest at the A2 segment (Fig. 1h, 20a). Puparium 1558-1793 [1695] long by 1016-1081 [1049] wide. Dorsal cuticle with subdorsal or submarginal lightly tessellated patches on one specimen and clear on other.

**Margin.** Row of apically rounded marginal teeth, subequal in width, and separated; basal area of teeth forming a narrow collar of marginal teeth (Fig. 20b); 2-3 prong structures arising from between the teeth and extending to the margin (Fig. 20b).

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present. Central lumen consisting of a clear center, outer narrow annulus (ring of cells) with larger cells and a narrow inner annulus with smaller cells. CP1 compound pores: 52-57 [55] in diameter, CP2: 44-66 [58], and CP3: 56-65 [60]. Central processes on all specimens were missing. Minute dorsal loculate pores (Fig. 20c) with a bright center (with a ring of faint 4-5 locules) ranged in diameter 4-5 (measuring 7 loculate pores on two specimens) most numerous around the vasiform orifice and distributed throughout the cuticle and along the basal row of teeth; simple solitary disc pores distributed on the dorsum.

**Chaetotaxy.** Marginal, subdorsal, and submedian (Fig. 20c) setae present. Anterior and posterior marginal setae present with all the AMS and PMS broken off; dorsal submedian setae (ASMeS and PSMeS) present on segments C1 (close to the submargin), C2 (anterior and lateral margin of the rostrum), T1, T2, T3 and A8. ASMeS(C1) only one seta intact and 15 long, ASMeS(C2) only two setae intact 12 and 13 long, ASMeS(T1 and T3) all broken off, ASMeS(T2) only one seta intact that is 21 long. PSMeS (A8) 22-31 [26] long; PVS (A8) only one ventral A8 setae intact (on the submedian of vasiform orifice ventrad of the operculum) 74 long; and the CS present at the base of the inner teeth with only one seta that is 24 long. With 10-12 subdorsal ASDS (3 intact setae measured) and 12 PSDS (6 intact setae measured): ASDS 13-17 [15] and PSDS 12-20 [17] long. Ventral setae at base of legs either missing or broken off.

**Vasiform orifice.** Cordate in shape the posterior venter of vasiform orifice reticulated (Fig. 20e), 131-154 [142] long and 105-116 [111] wide. Operculum (Fig. 20e) rectangular with a uniform rounded lateral margins (poorly defined due to condition) 60-67 long [63] long and 97-112 [104] wide; lingula (Fig. 20e) spatulate (longer than wide) and spinulose 89-99 [94] long by 57-75 [66]; tubercle small and oval or absent. Distance from posterior margin of vasiform orifice to the margin between the caudal setae is 120-124 [132].

**Venter.** Legs and antennae missing.

**Description. Male.** . Measurements in microns ( $\mu\text{m}$ ) were taken from one specimen (remounted) from the USNHM. **Slide mounted specimen.** Adult measurement at 5x power of the dissecting scope: length (from the cephalic vertex to the apical end of the claspers) 1907. Unable to determine width because of distortion.

**Cephalon.** Slightly truncate at the vertex. Antennae broken with only segment 1. Dorsal distance from the vertex to the posterior margin of the cephalon is 193 and transverse distance between the

innermost points of each compound eye is 130. A pair of ocelli proximal to the anterior inner margin of each compound eye. Area between upper and lower hemisphere of each compound eye obscured. From vertex to posterior margin of head and between ocelli and compound eyes are setae with varying lengths from minute to no longer than the diameter of the associated ocellus dorsally and ventrally.

**Thorax.** Only part of the hind leg is present (tarsus broken off), tibia with a comb of two rows of setae and one brush with four setae. One forewing (Fig. 20f) available for study 1602 long and 819 wide. Costa, subcosta, radius, forked radial veins (R1 and Rs), and cubitus vein (Cu) present. Large to small diffuse spotting (pigmented maculations) occurs marked by 11 maculations: one between costa and apical end of radius at the fork; two maculations between costa and R1; two maculations between R2 and Cu; two between radius and cubitus; and two between Cu and wing margin.

**Abdomen.** Ventral wax plates obscured. A3 to A6 tergites with clusters of discoidal pores. A9 tubular-shaped, 422 long by 204 wide being 2 times longer than wide.

**Vasiform orifice.** Orifice and lingula oriented laterally (Fig. 20h) with lingula 47 long a pair of curved claspers from 444 long with an acute apex and a row of small setae on the ventral surface; aedeagus (Fig. 20g) curved 184 long.

**Distribution.** Neotropical: Brazil.

**Host.** *Baccharis trimera* (Less) DC. (Asteraceae); undetermined plant; *Loranthus acutifolium* (Loranthaceae), *Phrygilanthus* sp. (Loranthaceae); *Spermacoce verticillata* Linnaeus (Rubiaceae)

**Material examined.** One slide with 2 puparia and one slide with an adult male (remounted): Brazil, Bahia, G. Bondar #672. Q23309, deposited at the USNHM.

**Comments.** Only one slide having 2 puparia in poor condition was available for study (from the USNHM); the specimens were remounted and examined. The characteristic spindle-shaped pigmented pattern cited by Bondar is evident extending at acute angles from the cephalon to below the vasiform orifice and only enclosing the abdominal compound pores. The diagnostic characters of the male were too damaged to be useful.

### *Bakerius sanguineus* Bondar (Fig. 21-23)

**Description (English translation of Bondar from Portuguese).** Egg and nymph yellowish in color; egg elongate 328  $\mu\text{m}$  long by 98  $\mu\text{m}$  wide; stem short and curved back; nymph pale yellow (translation from Bondar). Pale yellow becoming blood-red. When on the leaf, the nymphs and puparia are slightly covered with a white wax; three pairs of white strands of wax arise from the pores, attaining the length of 5 to 8 mm, directed upward, parallel and perpendicular to the dorsum. Measurements in microns ( $\mu\text{m}$ ) were taken from three nymphs and five puparia specimens from the USNHM. **Slide mounted puparium.** Body pale, ovoid (Fig. 21a, g), 992-1033 [1012] long by 576-649 [616] wide.

**Margin.** Row of apically rounded marginal teeth (Fig. 21b, c, d), subequal in width, and separated; basal area of teeth forming a narrow collar (Fig. 21b, c). Puparial margin finely dentate to smooth at 40x with few to no striations from the margin to the outer set of marginal teeth.

**Pores.** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 21a, c-d, g). Bondar stated that the abdominal compound pores were on segments A3 and A4; however, observed on segments A2 and A4. The diameter of CP1: 21-33 [27], CP2: 23-34 [28], and CP3: 21-30 [26]. Central process (when present) is light brown, cone shaped, narrow and apically acute (Fig. 21d), extending two-thirds the distance from the rim of the pore to the puparial margin, with the following lengths from the central lumen to the apex: CP1 central process: 40-41 [41] with only two cones intact for all specimens, CP2: 40-85 [65], and CP3: 37-86 [59]; central lumen consists of an outer annulus (ring of cells) with larger cells and splines. Large dorsal 4-5 loculate pores (Fig. 21c-e) present from the cephalothoracic to below the vasiform orifice and from the subdorsum to median forming an irregular row of pores across the



thoracic and abdominal segments and a cephalic cluster on the submedian to median area anterior to the rostrum; loculate pore diameter (measuring 10 pores) 7-9 [8]; few minute simple disc pores on the cephalothoracic and abdominal subdorsum to below the vasiform orifice, and not closely associated with compound pores. Reticulated floor of vasiform orifice with 5-8 simple disc pores.

**Chaetotaxy.** Anterior and posterior marginal setae present although only three setae were intact: AMS 12.2-18 [15] and PMS 10 [10]; dorsal submedian setae (ASMeS and PSMeS) present (Fig. 21c-e) on segments C1, C2, T1, T2, T3, A8, with lengths as follow: ASMeS(C1) 10-17 [13], ASMeS(C2) 7-16 [12], ASMeS(T1) 13-28 [21], ASMeS(T2) 16-23 [21], ASMeS(T3) 15-25 [21], PSMeS(A8) 23-31 [27]; AVS(T2) 22-45 [30], AVS(T3) 25-38 [31], PVS(A8) absent, PVS (VO) 36-52 [44] on lateral border of vasiform orifice (Fig. 21e), and CS present 18-29 [25]; submarginal row of setae present on each cephalothoracic and abdominal segment with ASDS and PSDS (Fig. 21c-d).

**Vasiform orifice.** Orifice (Fig. 21e) 75-87 [81] long and 68-85 [76] with posterior floor of vasiform orifice reticulated with disc pores visible through the lingula; operculum rectangular, 34-43 [38] long and 53-70 [51] wide, with round lateral margins and a bisinuate posterior margin, marked with a spinulose U-shaped band (Fig. 21e, g); lingula conical 31-42 [36] long by 36-46 [39] wide; tubercle (Fig. 21e-f) present on posterior border of orifice. Distance from posterior margin to vasiform orifice 107-154 [127].

**Venter.** Antennae long, annulated on the distal 2/3 of its length. Legs appear 3-segmented with T1 oriented toward anterior margin and T2 and T3 oriented toward posterior margins. Apical tarsal segment of legs 2 and 3 with a pair of setae at midpoint.

**Description. Nymph habitus (Stage 2). Slide mounted stage-2.** Measurements in microns ( $\mu\text{m}$ ) were taken from three nymphs loaned from the USNHM. Nymph pale, elongate, slightly tapering to the cephalic margin, widest between A1 and A2 (Fig. 22a); 797-800 [799] long by 467-475 [471] wide. Longitudinal suture not developed; transverse and mesothoracic-metathoracic sutures terminate at submedian depressions. A1 to A8 sutures present. The remainder of the dorsal and ventral cuticle is smooth unless otherwise noted.

**Margin.** Margin irregular (Fig. 22d); row of irregular marginal teeth (Fig. 22d).

**Pores.** Compound pores absent. Large dorsal loculate pores abundant from the submargin to the median and the cephalothorax to below the vasiform orifice (Fig. 22 c- d).

**Chaetotaxy** (Fig. 22b-d). Dorsum with marginal, subdorsal, dorsal submedian and ventral thoracic and vasiform orifice setal pairs (Fig. 22d). AMS and PMS present (Fig. 2b, d); ASMeS and PSMeS (Fig 22b, d)) present on segments with C1 close to the anterior submargin), C2 anterior and lateral margin of the rostrum), T1, T2, T3 and A8; PVS(VO) lateral to or directly from the floor of the orifice directly below the level of the operculum (Fig. 22d); PVS(A8) absent; AMS missing or broken off; only 10 pairs of ASDS observed and 13 long [13], ASMeS(C1) 12, ASMeS(C2) missing, ASMeS(T1) 9-13 [11], ASMeS(T2) 9-13 [11], AVS(T2) 14, ASMeS(T3) 12-22 [18], AVS(T3) 12; PMS 82; PSMeS(A8) 19-41 [30], PVS(A8) absent, PVS (VO) 30-44 [36], and CS 30 at the base of the inner teeth.

**Vasiform orifice** (Fig. 22d). Cordate in shape (Fig. 22a, d) with posterior floor reticulated; measured 67-70 [69] long and 63-70 [67] wide; operculum (Fig. 22d) with a straight anterior margin, rounded lateral margins and a lightly bisinuate posterior margin marked with a narrow spinulose U-shaped bisinuate band; operculum: 28-31 [30] long and 54 wide; lingula spatulate (slightly longer than wide) and spinulose 26-29 [28] long by 32-34 [33] wide with two pairs of subapical setae; oval tubercle present on posterior border of orifice. Distance from posterior margin of vasiform orifice to the margin between the caudal setae is 86 and 86.

**Venter.** Antennae short (same as Fig. 12b), apex bent and positioned anterior to the T1 legs lateral to the rostrum. T1 oriented toward the anterior-lateral margin, T2 and T3 toward the posterior-lateral margin, three segmented terminating in a claw with long setae, AVS (T2 and T3), associated at the midpoint on the basal segment of each T2 and T3 legs.

**Description. Adult (unknown gender).** Adult in poor condition with only thoracic segments. Wing maculations (Fig. 23) do not match pattern in Penny and Arias (1980).

**Distribution.** Neotropical: Brazil, Canal Zone (Panama).

**Host.** Araceae, unknown host.

**Material examined.** Three puparia and 1 nymph collected by J. Bondar 13-xii-1923 on unknown plant from Bahia, Brazil, deposited in the USNHM (P23143); three puparia collected by J. Zetek 12-iii-1923 on Araceae from the Canal Zone, deposited in the USNHM (Q23099).

**Comments.** This is the only species that has large loculate pores with 4-5 locules and a diameter of 7 µm or more.

***Bakerius sublatus*** Bondar 1928  
(Fig. 24-25)

**Description.** Uniformly yellowish in color. ***Puparium habitus.*** Measurements in microns (µm) were taken from three cotype puparia from the USNHM. *Slide mounted specimens.* Body ovoid (Fig. 24a,e), 1312-1483 [1370] long by 951-1039 [1002] wide.

***Margin.*** Puparial margin finely dentate to smooth at 40x with few to no striations from the margin to the outer set of marginal teeth. Row of apically rounded teeth, subequal in width (Fig. 24b).

***Pores.*** CP1, CP2 (on A2), and CP3 (on A4) present (Fig. 24a, f) present with the following diameters (Bondar lists the diameter of each pore as “49.2 microns”): CP1: 45-48 [47], CP2: 46-51 [49], and CP3: 47-56 [50]. Central process (when present) is light brown, cone shaped (Fig. 24d), narrow and apically acute, extending ½ its length from the rim of the pore, with the following lengths from the central lumen to the apex: CP1 central process: 48 (all others broken off), CP2 process: 52 (all others broken off), and CP3 process: 41-48 [48]. Central lumen with an outer ring of cells and an inner ring of splines. Minute loculate pores (Fig. 24d-e) ranging in diameter (measuring six loculate pores around the vasiform orifice) 5-7 [6], distributed dorsally from the cephalothorax to below the vasiform orifice from the base of the marginal teeth to the subdorsum, submedian and median; simple disc pores of various sizes distributed on the dorsum not closely associated with compound pore; 8-12 disc pores present on the reticulated floor of the vasiform orifice; simple disc pores from the subdorsum to the median to the lateral angle of the vasiform orifice.

***Chaetotaxy*** (Fig. 24c and e). Anterior and posterior marginal setae broken off; ASMeS and PSMeS present on segments C1, C2, T1, T2, T3, A8, with lengths as follow: ASMeS(C1) 9-25 [16], ASMeS(C2) 25-32 [27], ASMeS(T1) 24-28 [26], ASMeS(T2) 24-27 [26], ASMeS(T3) 23-25 [27], PSMeS(A8) 36-53 [40]; AVS(T2) and AVS(T3) are unknown (cannot observe since legs are distorted), PVS(A8) absent, and, PVS(VO) 57-69 [63] on lateral border of vasiform orifice of one cotype, and CS present 19-59 [39]; submarginal row of setae present on each cephalothoracic and abdominal segment numbering 6 anterior and 6 abdominal pairs with ASDS (nine setae) that are 19-42 [29] long and PSDS (7 setae) 28-49 [42] long.

***Vasiform orifice*** (Fig. 24e, g). 131-134 [132] long and 107-111 [109] with posterior floor of vasiform orifice reticulated with disc pores visible through the lingula; operculum rectangular, 54-58 [56] long and 77-80 [78] wide, with a bisinuate posterior margin and marked with a spinulose U-shaped band; lingula broadly conical 54-56 [55] long by 55-58 [57] wide; oval tubercle present on posterior border of orifice. Distance from posterior margin of vasiform orifice is 151-199 [177].

***Venter.*** Antennae long, annulated on the distal 2/3 of its length. Legs appear 3-segmented with forelegs oriented toward anterior margin and middle and hind legs oriented toward posterior margins. Apical tarsal segment of legs 2 and 3 with a pair of setae at midpoint.

**Description. Adult female.** Only the wings (Fig. 25) were suitable for imaging from cotype specimen from the USNHM. Forewing 2122 long and 1507 wide (Fig. 25a); hind wing (Fig. 25b) broken off or distorted, not measured. Forewing with 15 diffused maculations and spots: two spots and three diffused maculations between costa-subcosta and radius-R1 veins; one spot and one maculation between R1 and Rs; three spots and two maculations between R2 and Cu; and three maculations and one spot between Cu and the posterior wing margin. Hind wing with nine

maculations: one between R1-radius and costa veins; two between R1 and Rs; four between Rs and Cu and two between Cu and posterior wing margin.

**Distribution. Neotropical:** Brazil.

**Host.** Indeterminate host.

**Material Examined.** Four cotype puparia (one slide) and one adult female (one slide) with notation "Dr. Howard's memo of June 20, 1929"; deposited at the USNHM.

**Comments.** This species has a pale puparium and can be separated from all the other pale species by the following: from *Bakerius glandulosus* Hempel because the latter is cited by Hempel 1938 as having two complete rows of marginal teeth, whereas *B. sublatus* has one complete outer row; from *B. sanguineus* which has large compound pores (3-4 locules) from 7 to 9  $\mu\text{m}$  in diameter, whereas those of *B. sublatus* have 8-10 locules and are normally 5-6  $\mu\text{m}$  in diameter.

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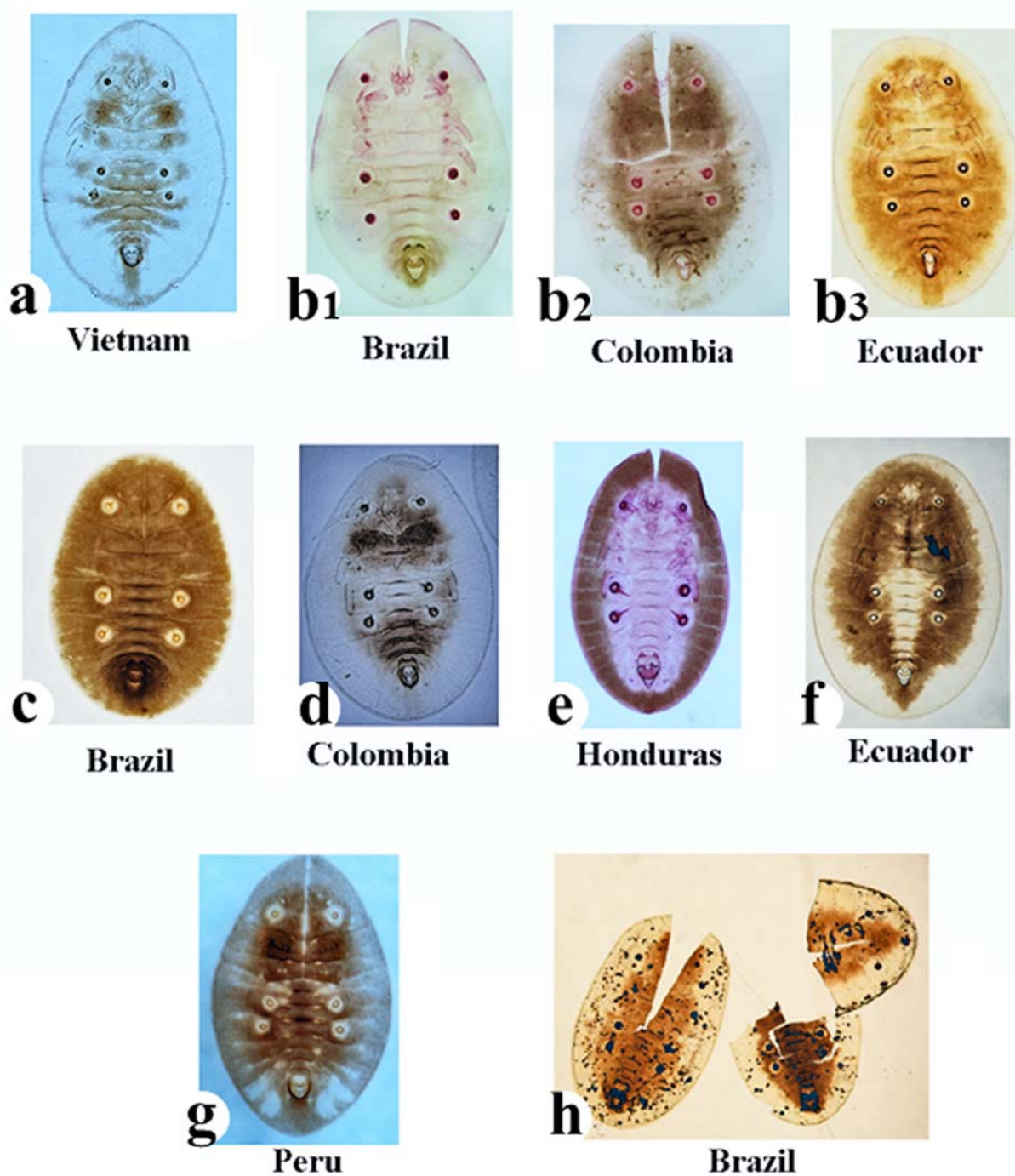
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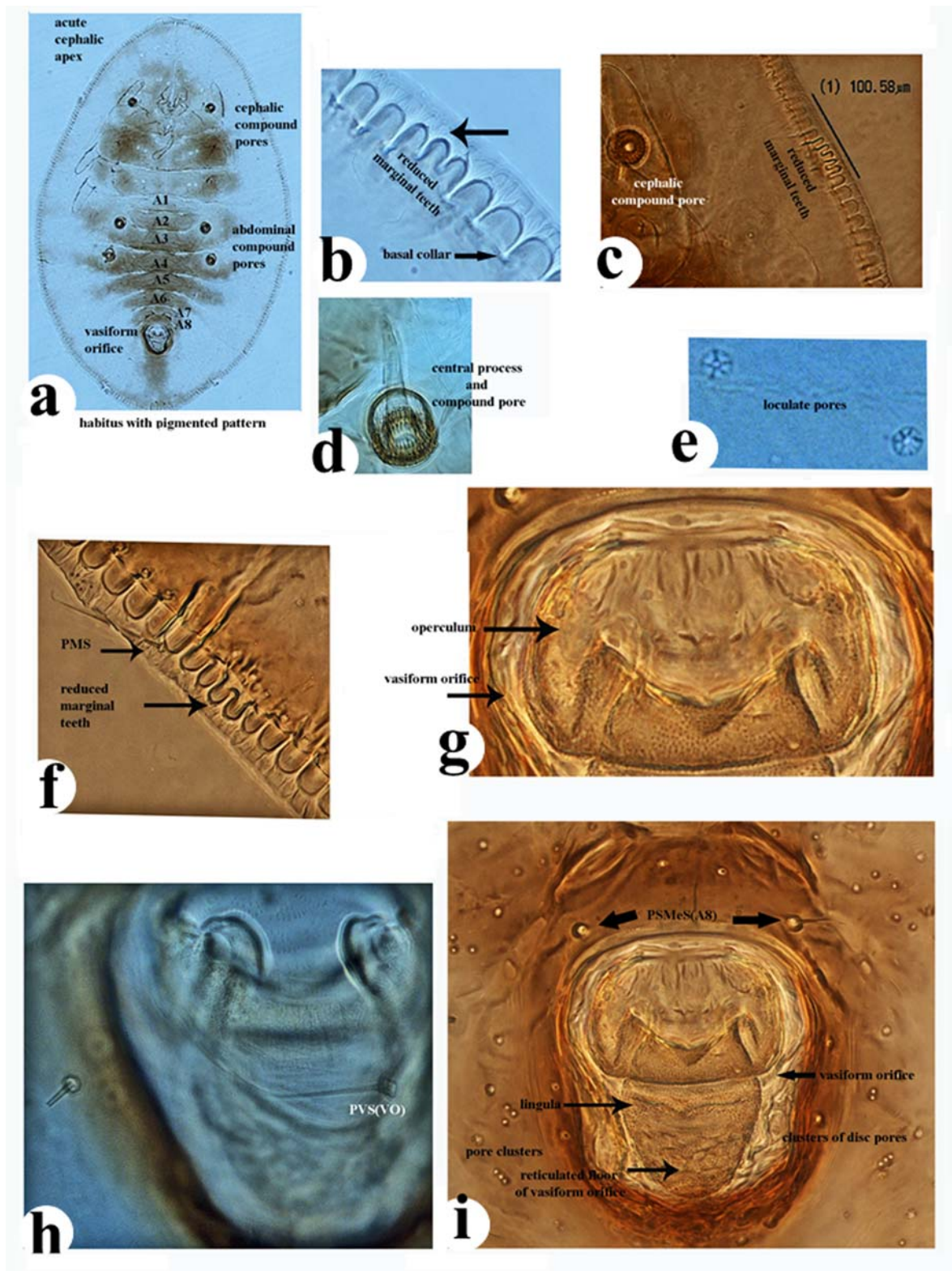
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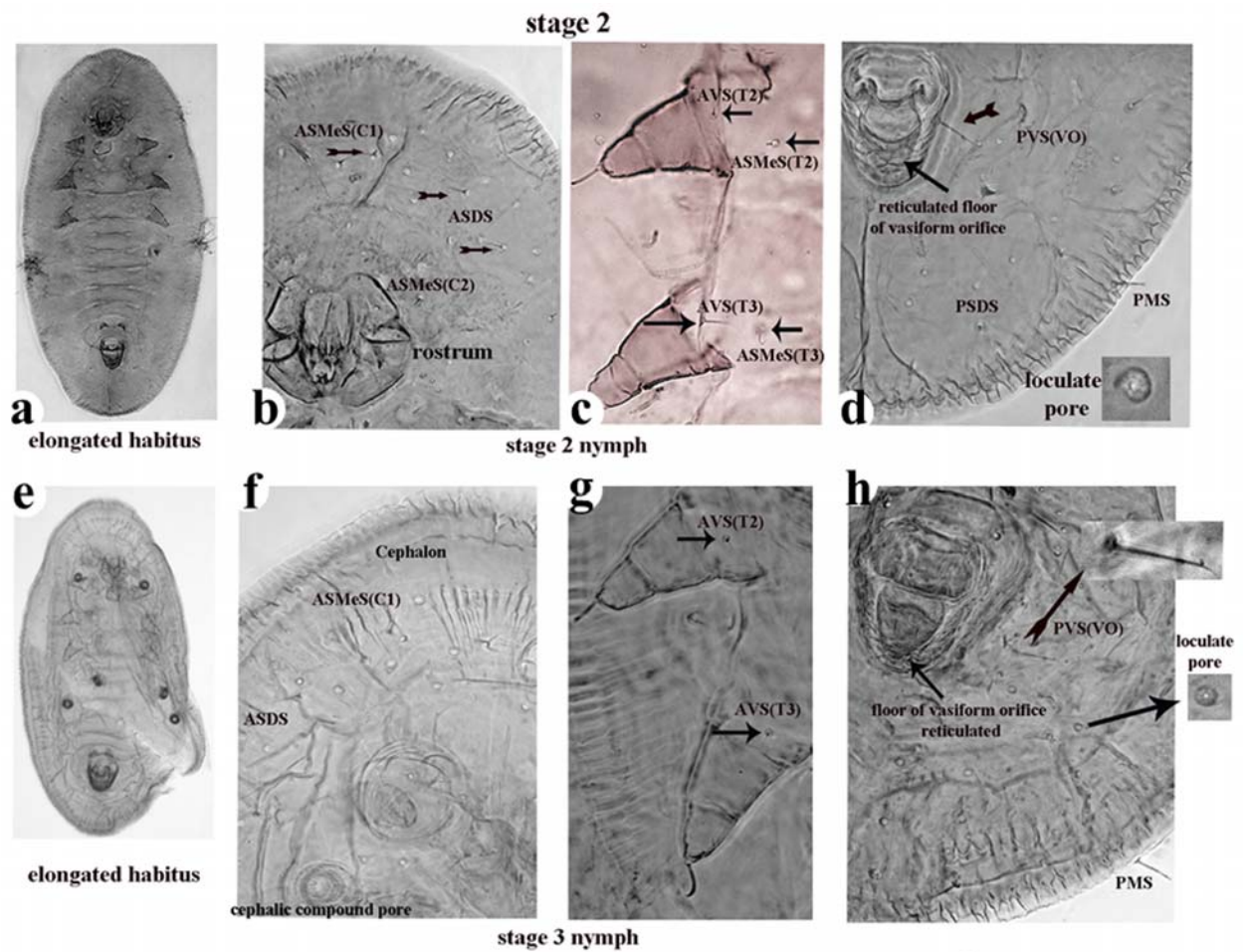


**Figure 1.** Habitus of *Bakerius* spp. with pigmentation patterns on puparia. **a)** *B. asiaticus*; **b1-3)** *B. attenuatus*; **c)** *B. calmoni*; **d)** *B. colombianus*; **e)** *B. hondurensis*; **f)** *B. leei*; **g)** *B. peruvianus*; **h)** *B. phrygilanthi*.



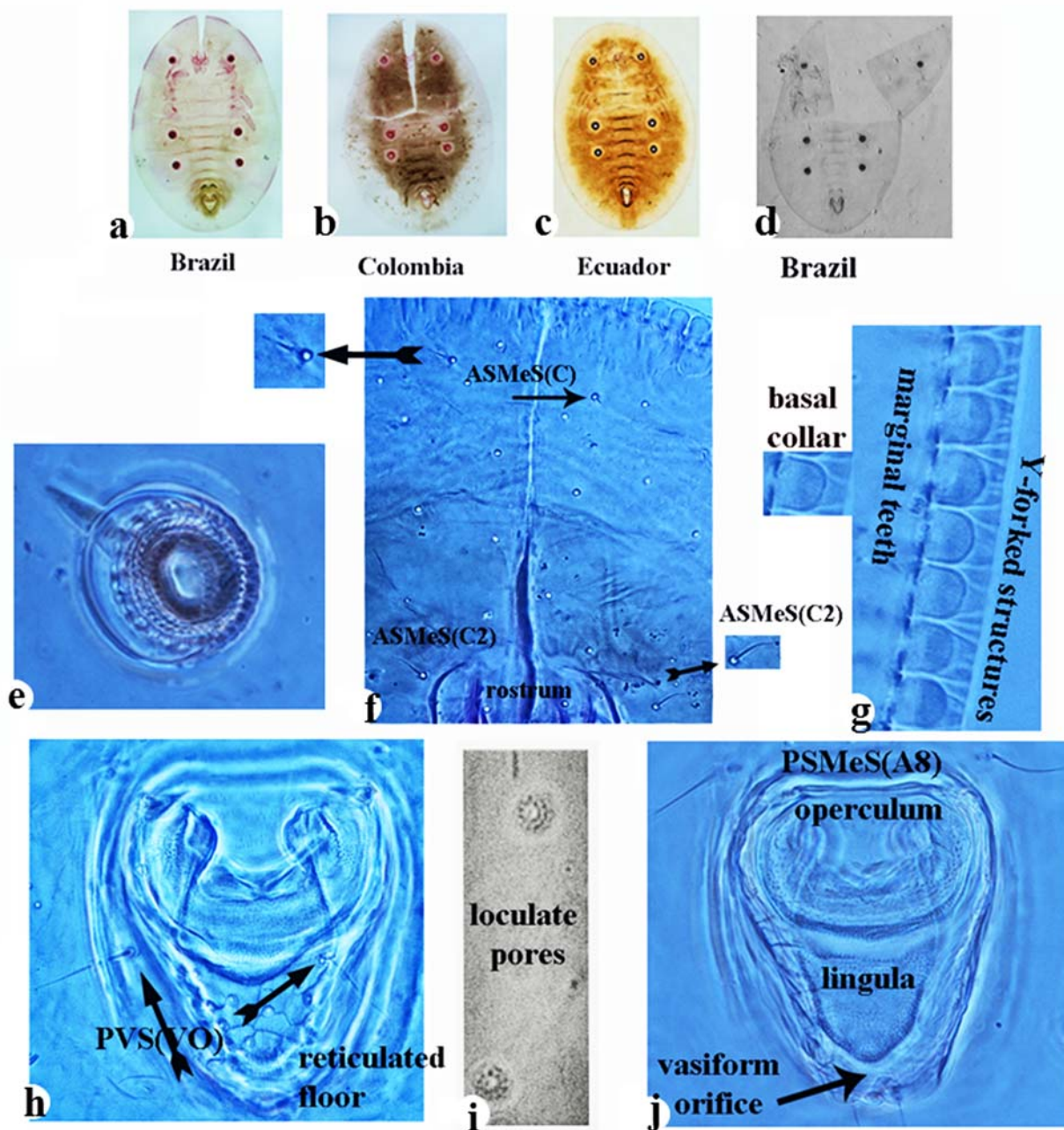


**Figure 2.** *Bakerius asiaticus* sp. nov. Dooley and Smith-Pardo (pupa). **a)** pigmented habitus; **b)** and **c)** row of marginal teeth showing teeth with reduced width; **d)** central process and compound pore; **e)** loculate pores; **f)** PMS anterior of reduced marginal abdominal teeth; **g)** operculum; **h)** SVS; **i)** clusters of simple disc pores, PSMeS(A8), vasiform orifice, reticulated floor, lingula and operculum.

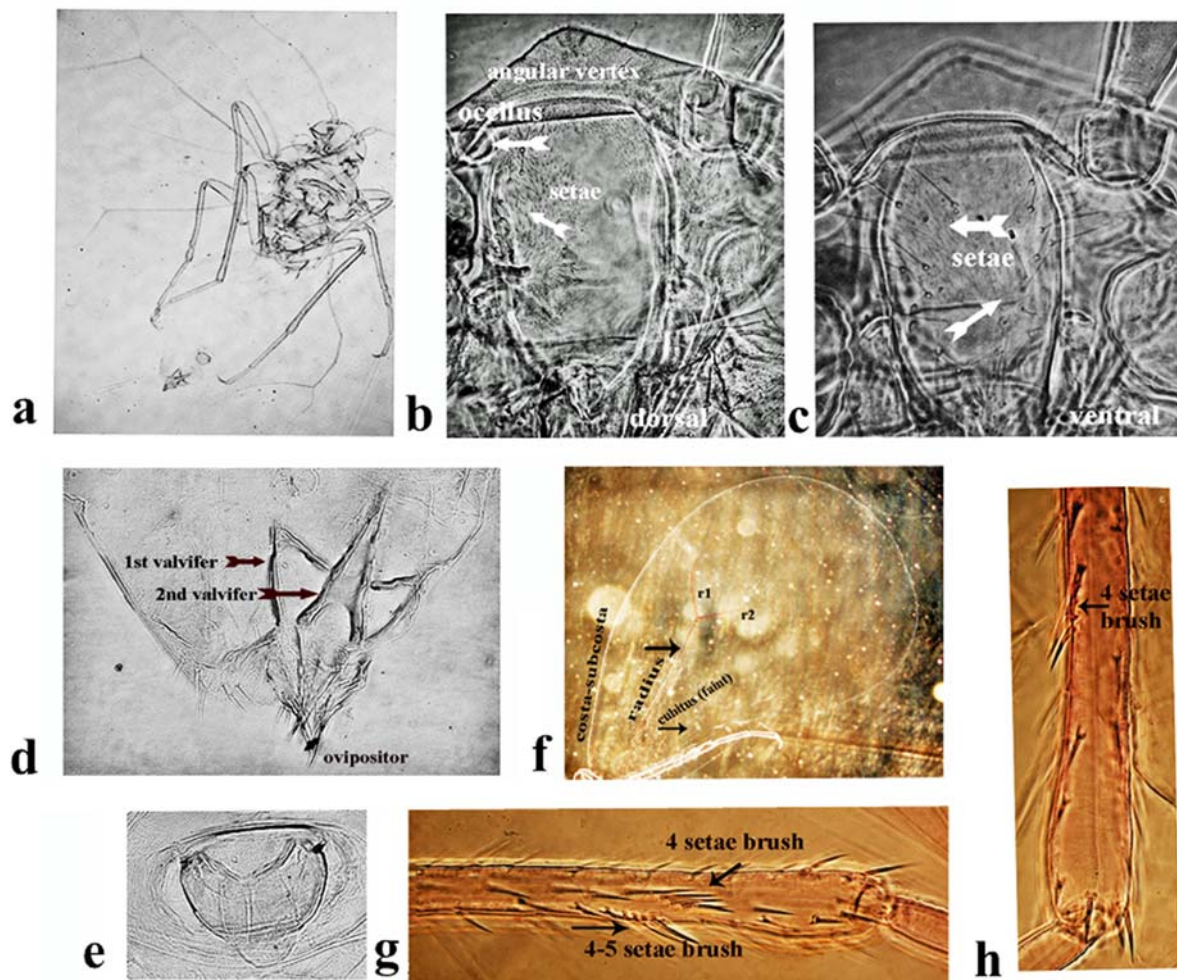


**Figure 3.** *Bakerius asiaticus* sp. nov. Dooley and Smith-Pardo (nymphs). **a)** stage 2 pale habitus; **b)** rostrum, cephalic ASMeS and ASDS; **c)** thoracic ASMeS and AVS (near base of T2 and T3 legs); **d)** PMS, PVS and reticulated floor of vasiform orifice; **e)** stage 3 nymph habitus; **f)** cephalic ASMeS and ASDS; **g)** thoracic AVS (near base of T2 and T3 legs; **h)** PMS, PVS(VO) and reticulated floor of vasiform orifice.



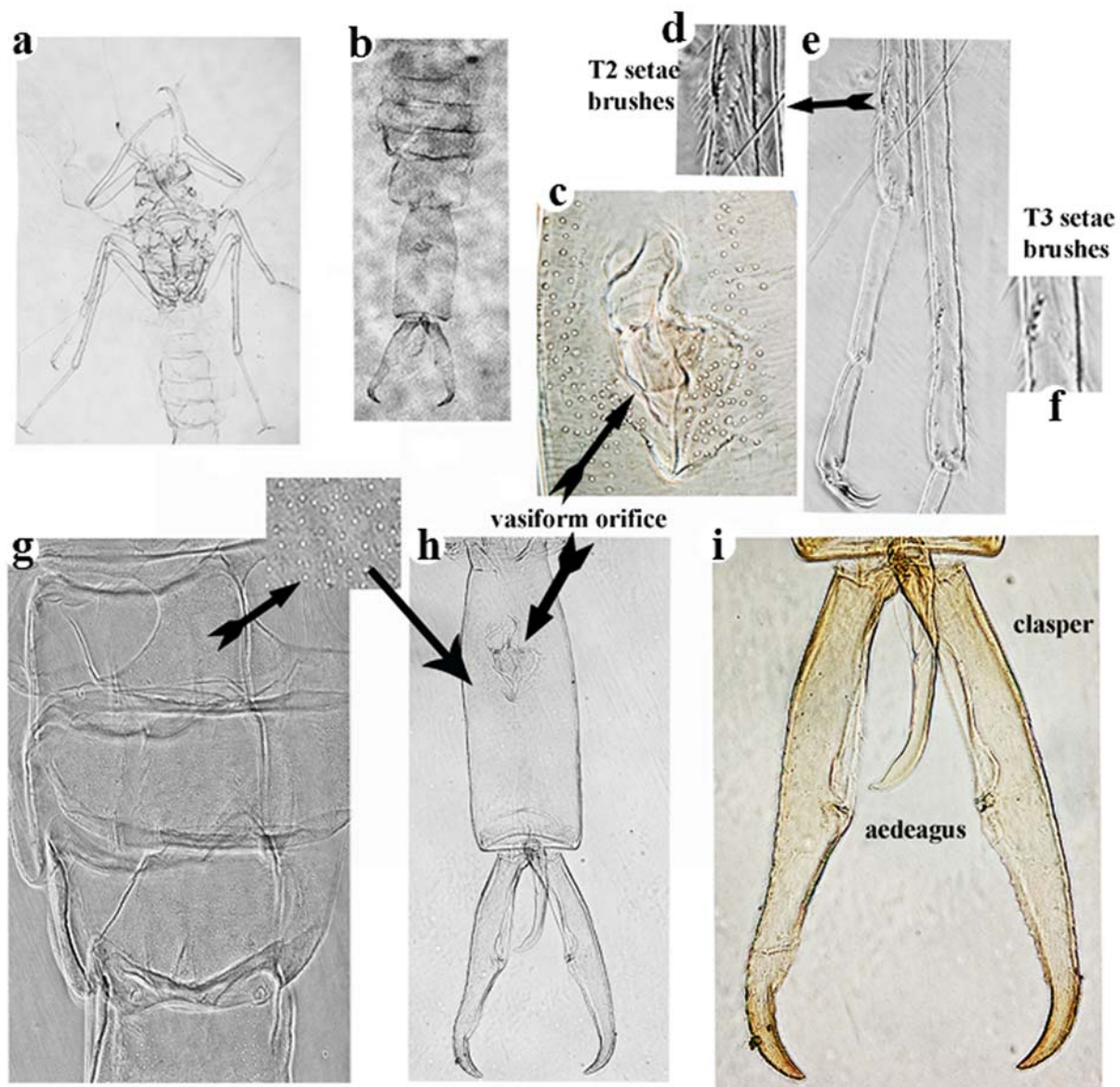


**Figure 4.** *Bakerius attenuatus* (pupa). **a)** pigmented habitus at vasiform orifice only; **b)** and **c)** variable pigmentation; **d)** pale form; **e)** central process and compound pore; **f)** rostrum, ASMeS(C1 and C2); **g)** row of marginal teeth and margin with Y or forked-shaped structures; **h)** venter of vasiform orifice showing reticulated floor, associated pores, and PVS(VO) pair; **i)** loculate pores; **j)** dorsum of vasiform orifice with PSMes(A8), operculum, lingula.



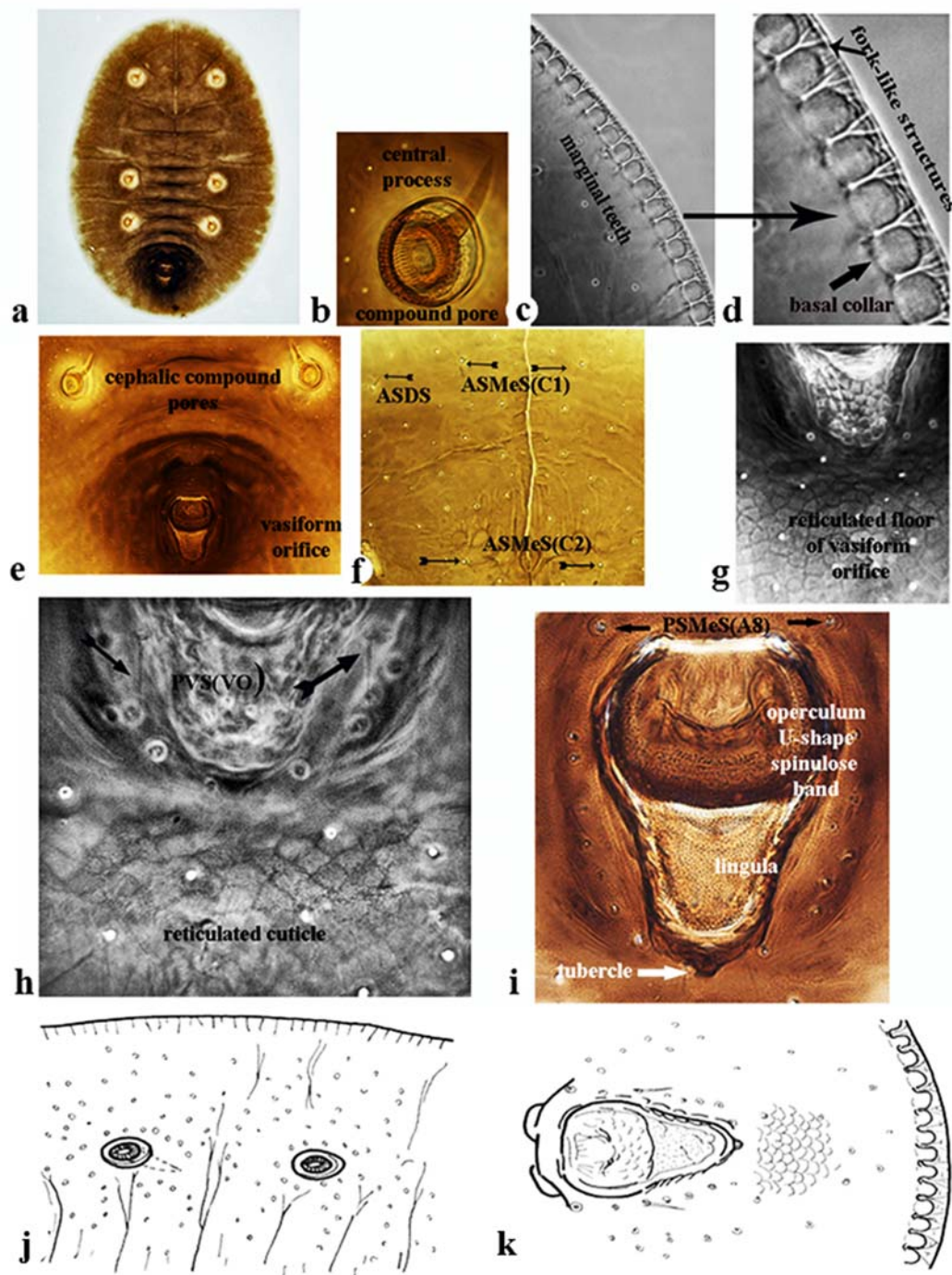
**Figure 5.** *Bakerius attenuatus* (adult female). **a)** habitus; **b)** dorsal setae present from vertex to rostrum; **c)** ventral setae between vertex and rostrum; **d)** ovipositor and valvifers; **e)** vasiform orifice and lingula; **f)** veins (anterior wing): costa-subcosta, radius, fork (radius 1 and radius 2), and cubitus; **g)** T2 tibia with two pairs of setae brushes; **h)** T3 tibia with one pair of setae brushes.



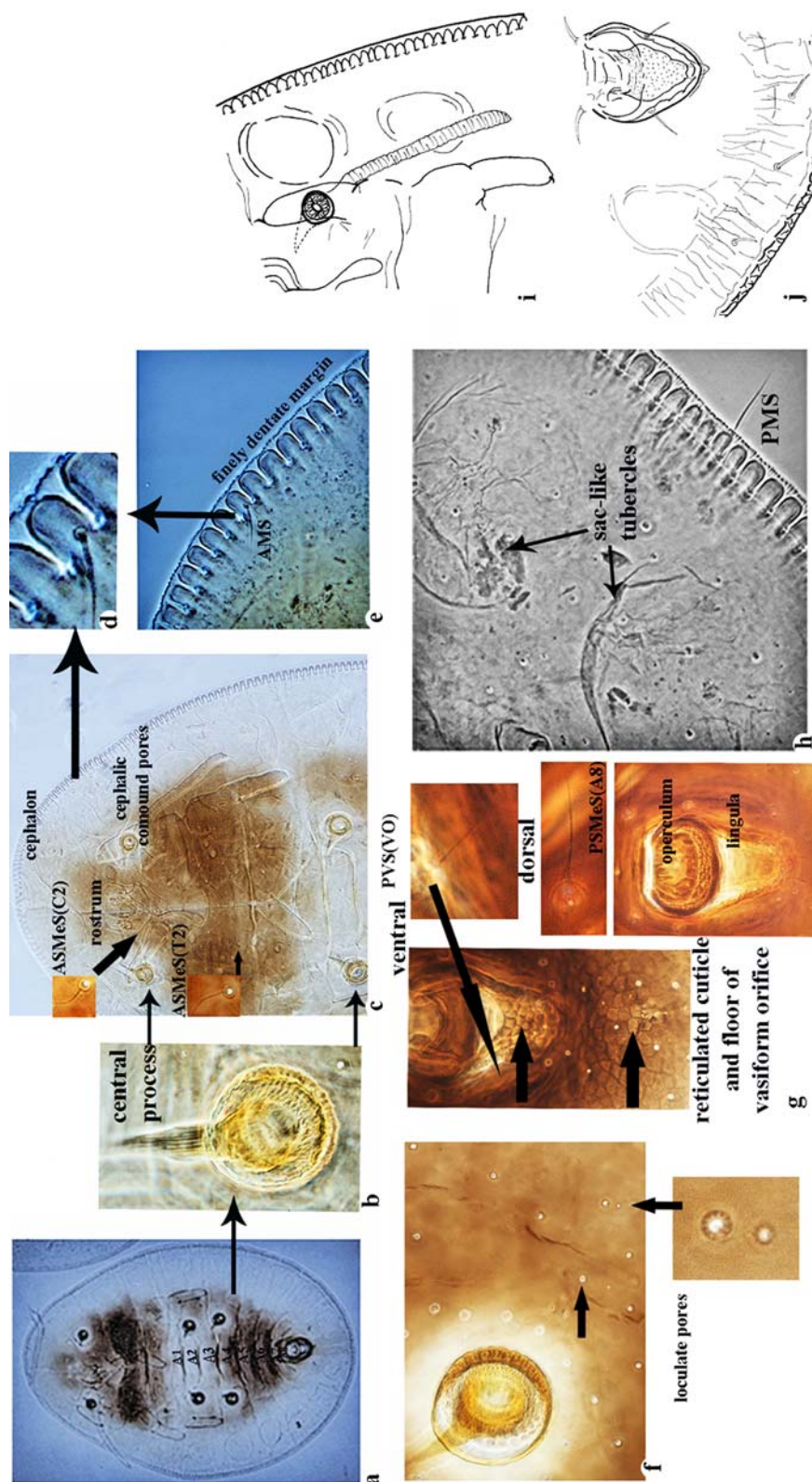


**Figure 6.** *Bakerius attenuatus* (adult male). **a)** habitus; **b)** terminal segments, claspers and aedeagus; **c)** vasiform orifice surrounded by pore clusters; **d)** T2 tibia with two pairs of setae brushes; **e)** T2 and T3 tibia, tarsus and claw; **f)** T3 tibia with one pair of setae brushes; **g)** abdominal sclerites with pore clusters; **h)** vasiform orifice with pore clusters on elongated abdominal segment; **i)** a pair of claspers with an aedeagus.



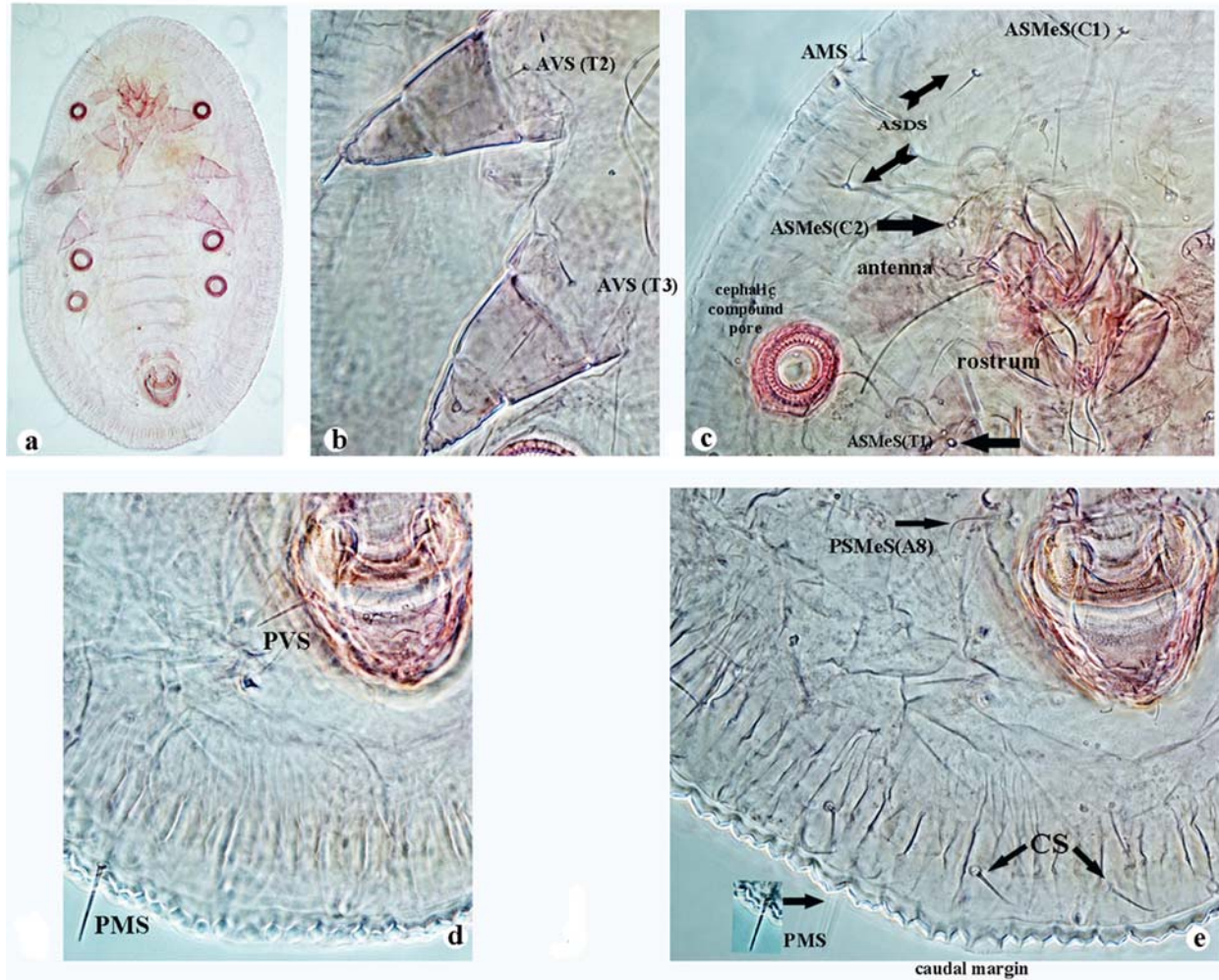


**Figure 7.** *Bakerius calmoni*. **a)** pigmented habitus; **b)** compound pore and central process; **c)** marginal teeth; **d)** fork-like processes to margin arising between teeth; **e)** A4 compound pores with central processes anterior to vasiform orifice; **f)** ASDS and ASMeS C1 and C2; **g)** reticulated floor of anal area surrounding vasiform orifice; **h)** PVS(VO) and reticulated cuticle; **i)** spinulose operculum and lingula; **j)** illustration of part of abdomen showing loculate and simple pore distribution; **k)** reticulation posterior of vasiform orifice.

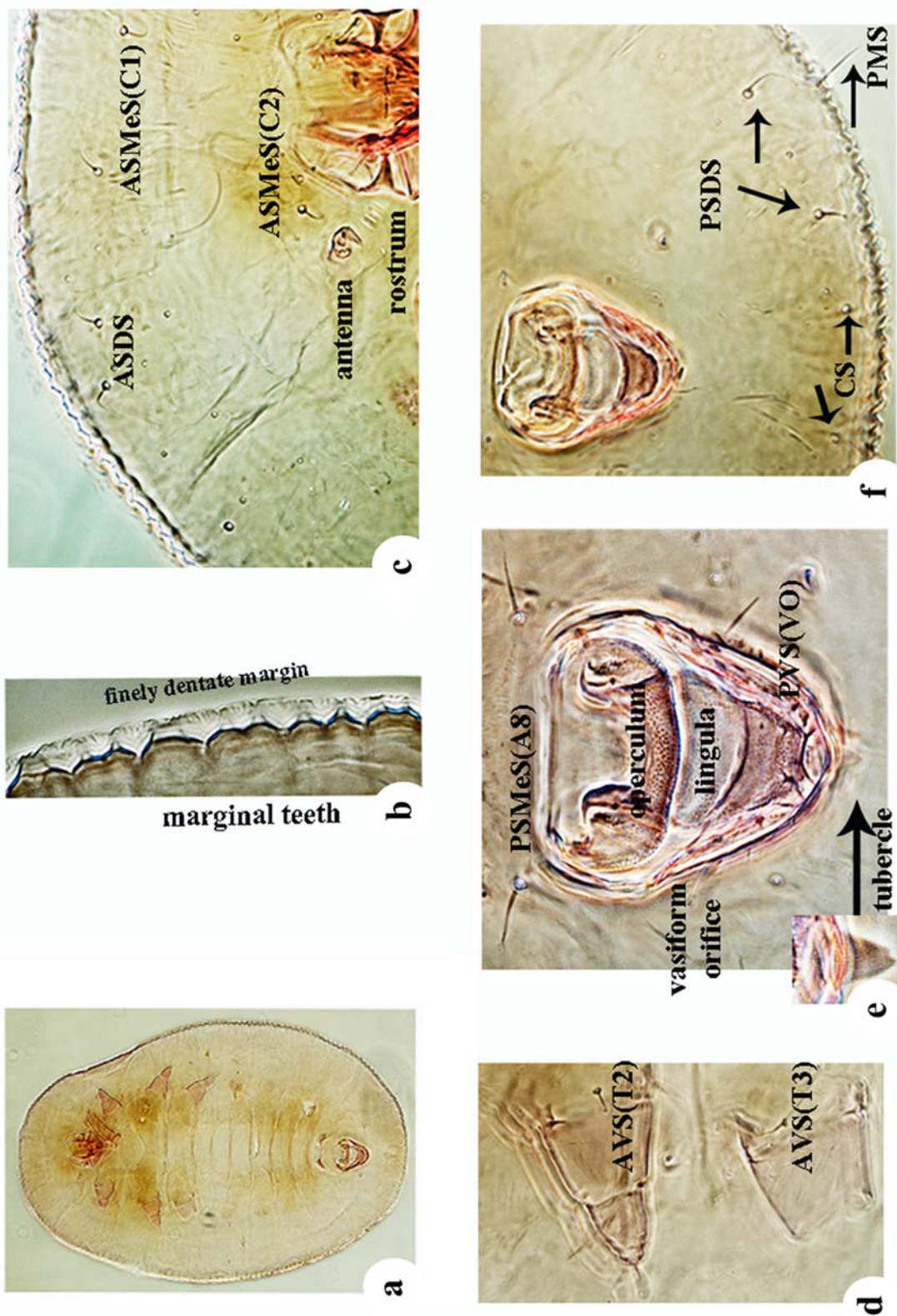


**Figure 8.** *Bakerius colombianus* (pupa). **a)** pigmented habitus; **b)** compound pore and central process; **c)** cephalothorax of puparium; **d)** AMS arising from base of tooth; **e)** one row of marginal teeth; **f)** abdomen of puparium; **g)** reticulated cuticle around vasisform orifice and sac-like tubercles; **h)** PMS, marginal teeth, finely dentate margin, and reticulated cuticle with sac-like like tubercles; **i)** illustration of thorax and submarginal teeth; **j)** illustration of vasisform orifice with setae, submarginal abdominal setae, and hyaline abdominal tubercular sacs.



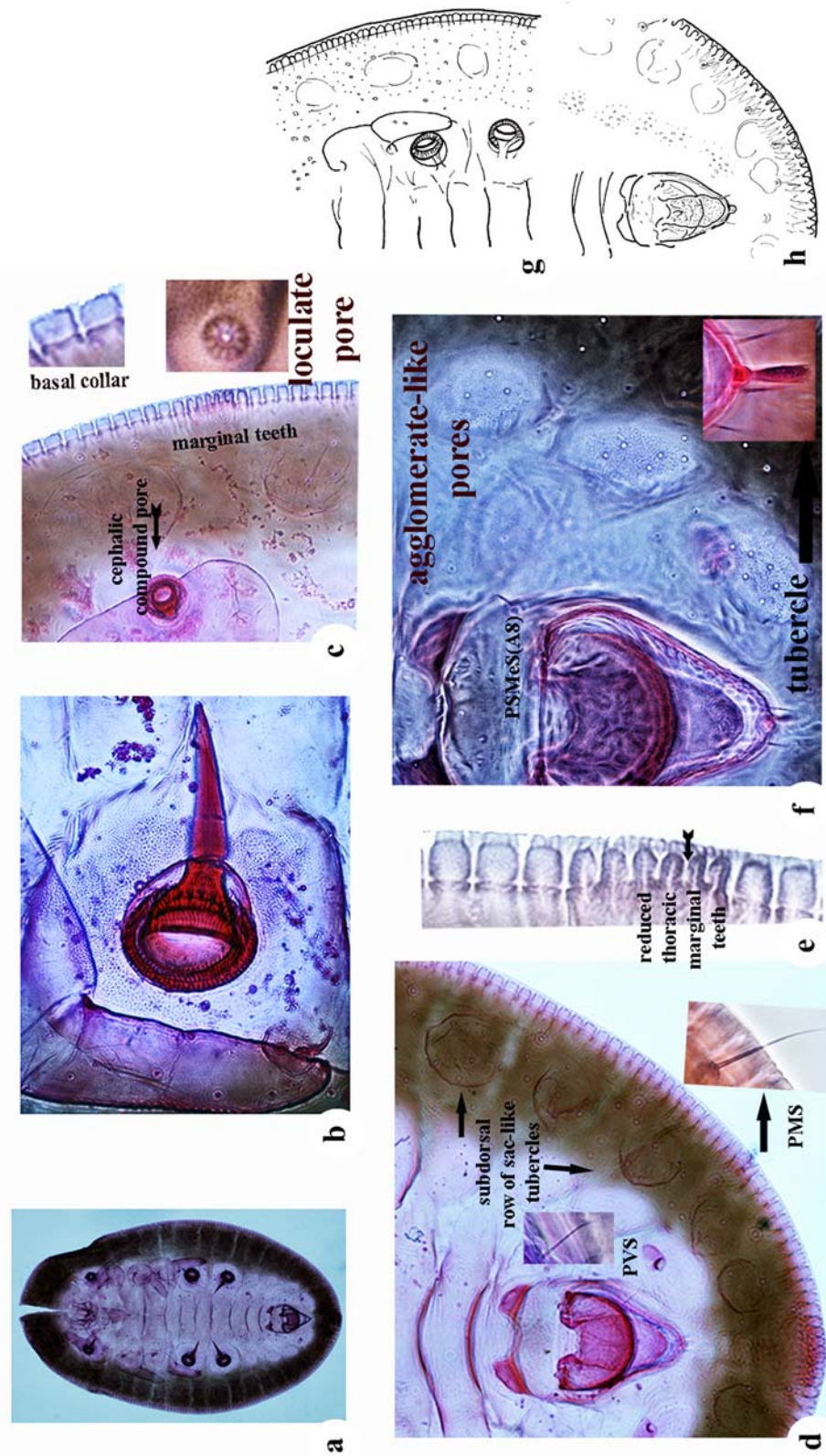


**Figure 9.** *Bakerius colombianus* (stage 3 nymph). **a)** pale habitus; **b)** AVS (T2 and T3) at base of legs; **c)** AMS, ASDS, ASMeS (C1 and C2), ASMe(T1), antenna, cephalic compound pore, and rostrum; **d)** PMS, PVS(VO), vasiform orifice, containing lingula and operculum, with reticulated floor and posterior tubercle PMS; **e)** CS, PMS, PSMes(A8), caudal margin, vasiform orifice with operculum and lingula.



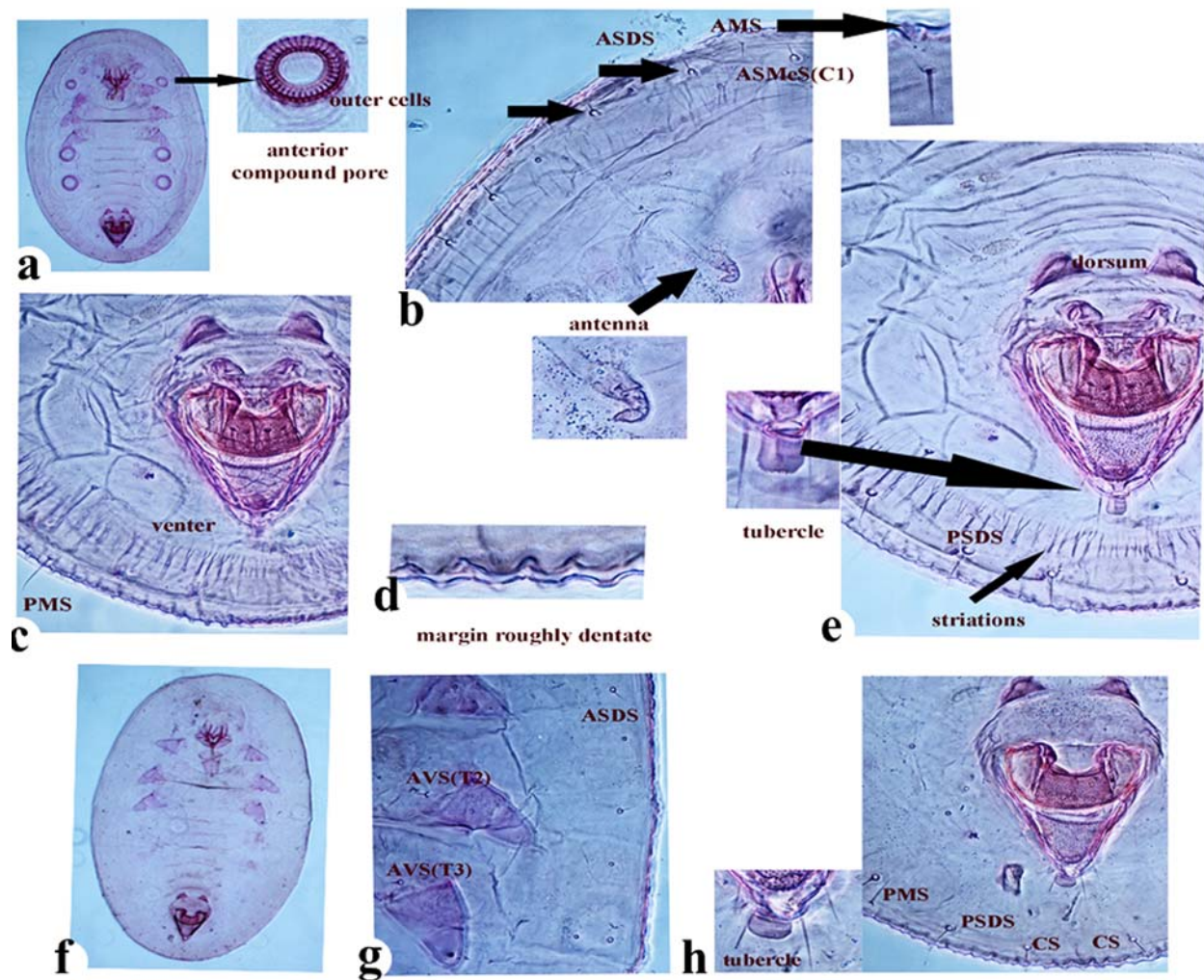
**Figure 10.** *Bakerius colombianus* (stage 2 nymph). a) pale habitus; b) dentate margin and submargin; c) ASDS, ASMeS (C1 and C2), antenna, and rostrum; d) AVS on T2 and T3 at base of legs; e) PSMes(A8), PVS(VO), vasiform orifice with operculum, lingula, and posterior tubercle; f) CS, PMS, PSDS, and vasiform orifice.



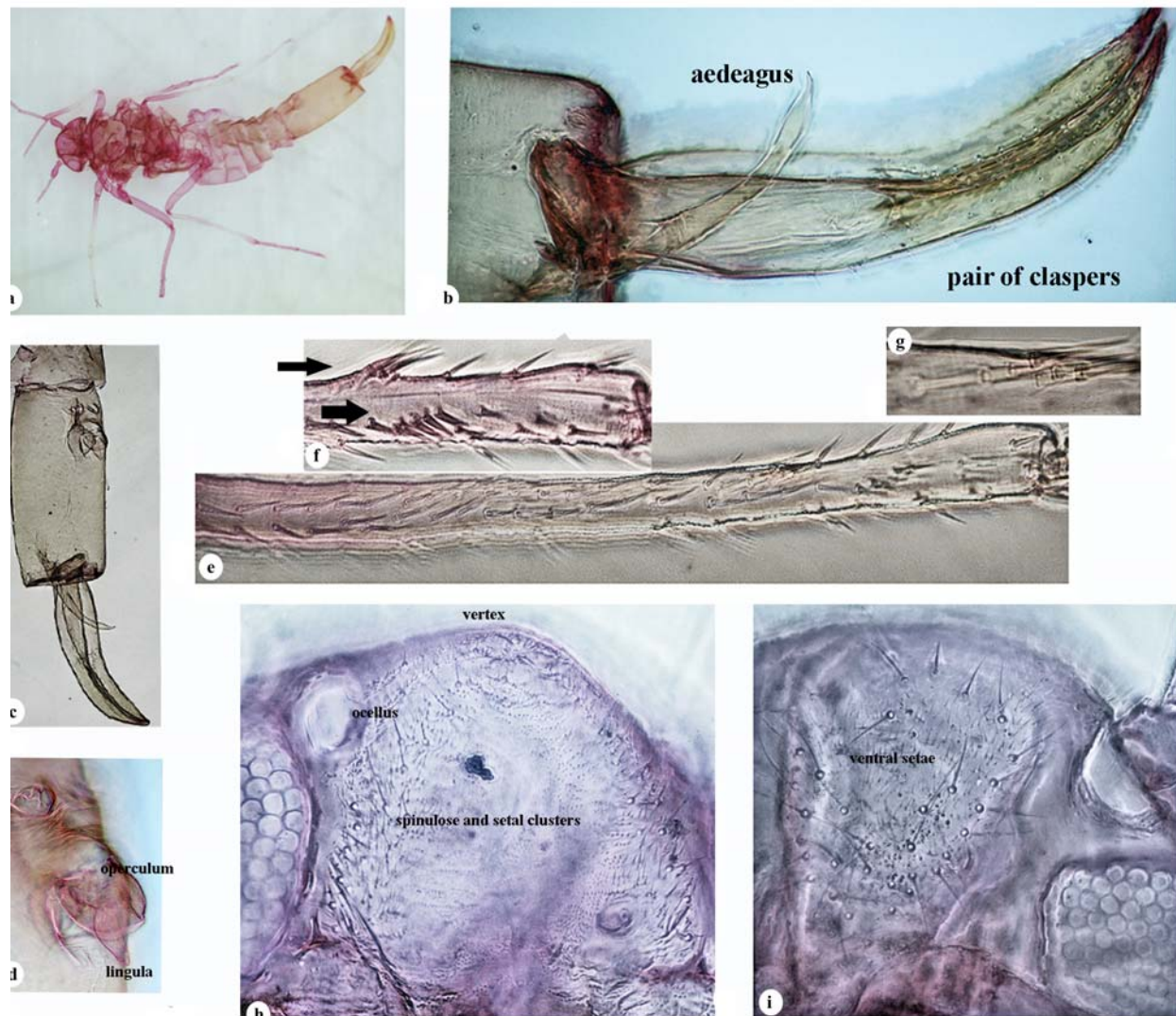


**Figure 11.** *Bakerius hondurensis* (pupa). **a)** pigmented habitus; **b)** cephalic compound pore with associated central process surrounded by stippled area; **c)** cephalic compound pore; marginal teeth with thoracic teeth reduced; **d)** PMS, PVS(VO), and sac-like tubercles; **e)** reduced thoracic marginal teeth; **f)** PSMes(A8), paired subdorsal agglomerate-like pores, and vasiform orifice with operculum, lingula, tubercle, and reticulated floor; **g)** illustration of submarginal teeth; **h)** illustration of vasiform orifice with setae, submarginal abdominal setae, and hyaline abdominal tubercular sacs.



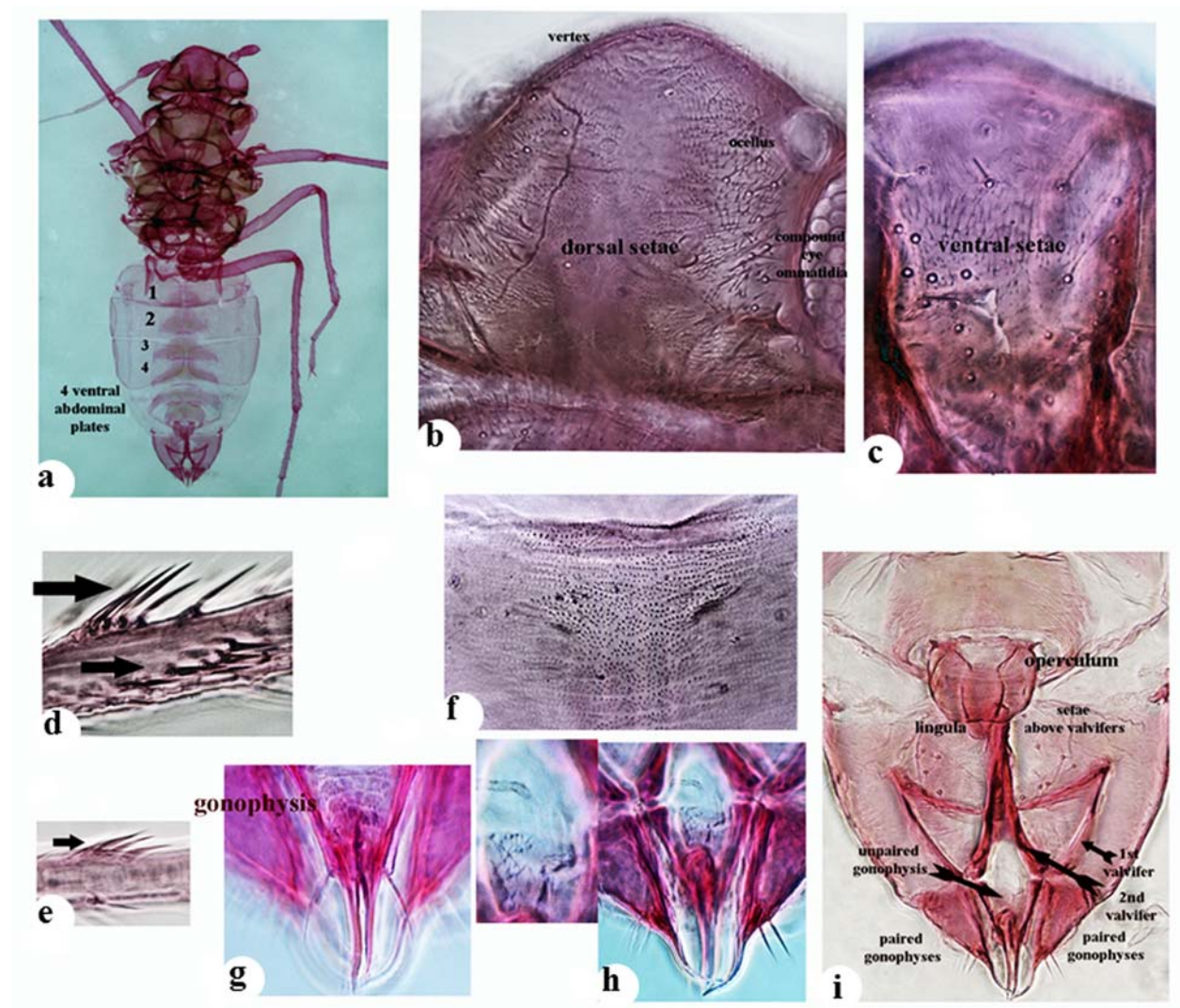


**Figure 12.** *Bakerius hondurensis* (nymph). **a-e)** stage 3. **a)** habitus with cephalic compound pore; **b)** antenna, AMS, ASDS, ASMeS; **c)** venter with PMS and vasiform orifice; **d)** dentate margin; **e)** dorsum with PSDS, vasiform orifice and tubercle; (f-h) stage 2 **f)** habitus; **g)** ASDS, AVS(T2 and T3); and **h)** CS, PMS, PSDS, vasiform orifice and tubercle.

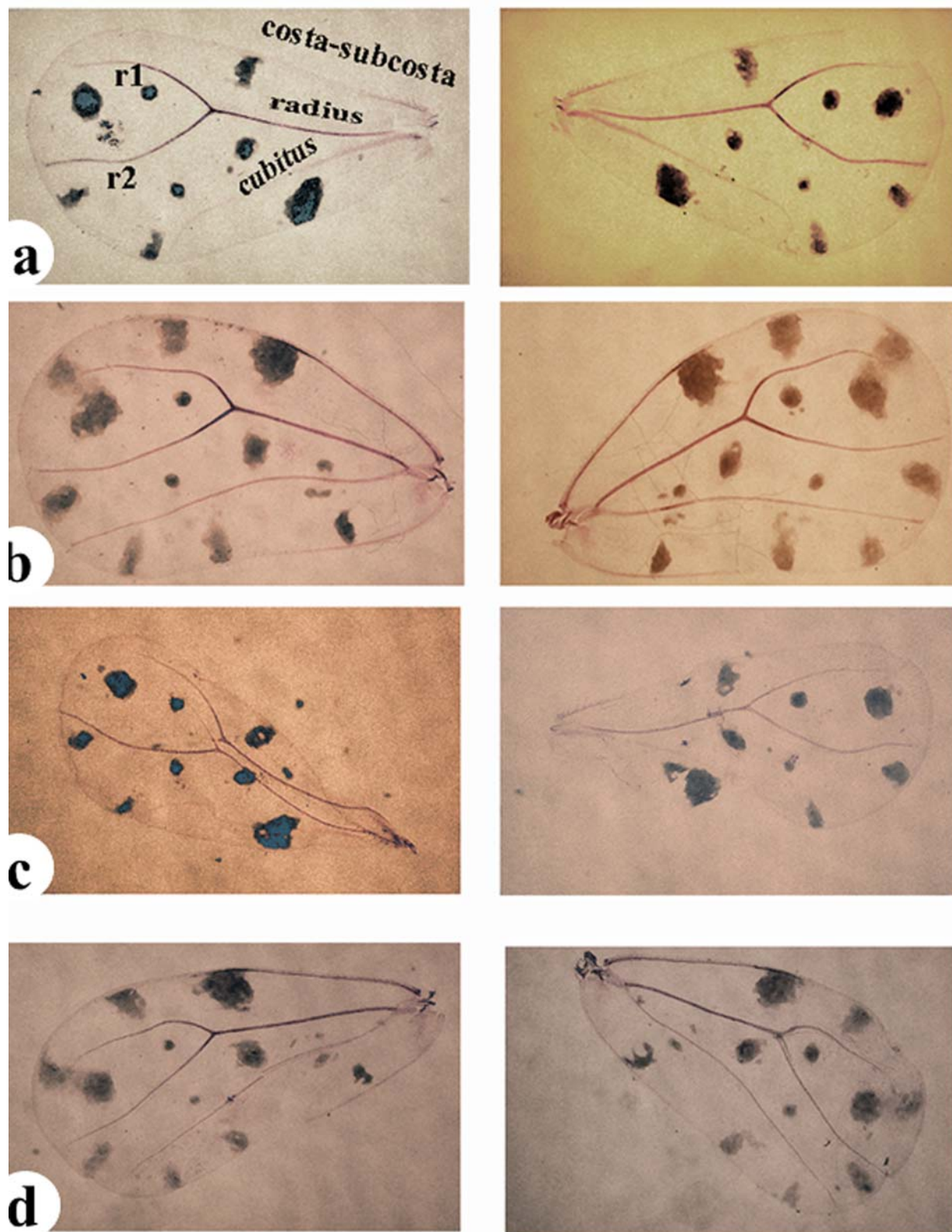


**Figure 13.** *Bakerius hondurensis* (adult female). **a)** habitus showing two pairs of ventral abdominal plates and submedian pigmented sternites; **b)** dorsal cephalic setal clusters; **c)** ventral cephalic setal clusters; **d)** two setal brushes on mesotibia; **e)** one setal brush on metatibia; **f)** spinulose abdominal sternite present on all sternites anterior to vasiform orifice; **g)** vasiform orifice with operculum, lingula; setal rows anterior to valvifers; **h)** gonophyses, ovipositor, and valvifers; **i)** operculum, gonophyses, ovipositor, and valvifers enlarged.



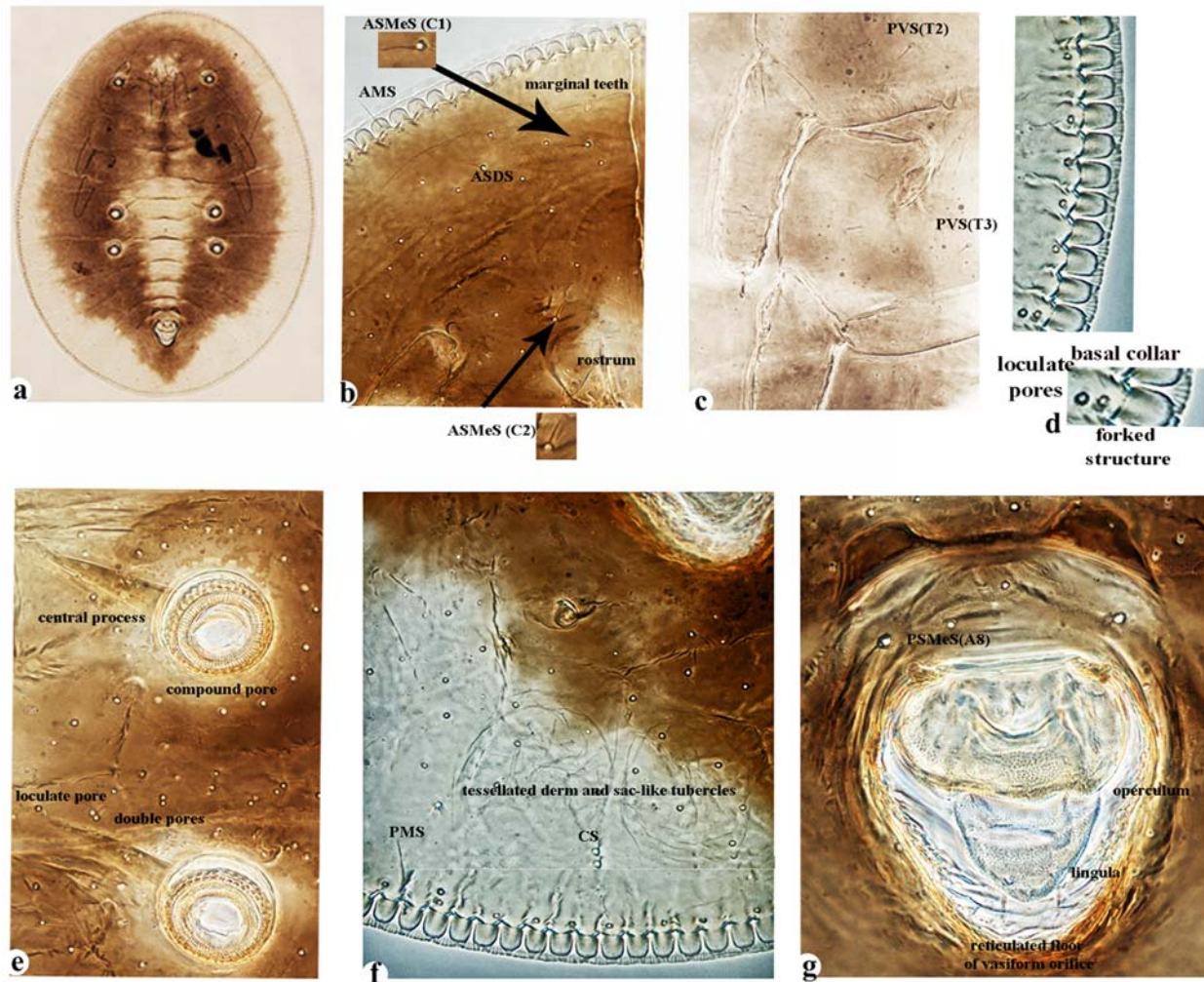


**Figure 14.** *Bakerius hondurensis* (adult male). **a)** habitus; **b)** aedeagus and a pair of claspers; **c)** elongated A8 segment, vasiform orifice, aedeagus and a pair of claspers; **d)** vasiform orifice and lingula; **e)** metatibia; **f)** mesotibia with two brushes with 3 and 4 setae; **g)** metatibia with one brush of four setae; **h)** cephalic dorsum showing setal clusters and spinulose cuticle; ocellus, and compound eye; **i)** cephalic venter showing setal clusters and spinulose cuticle; ocellus, and compound eye.



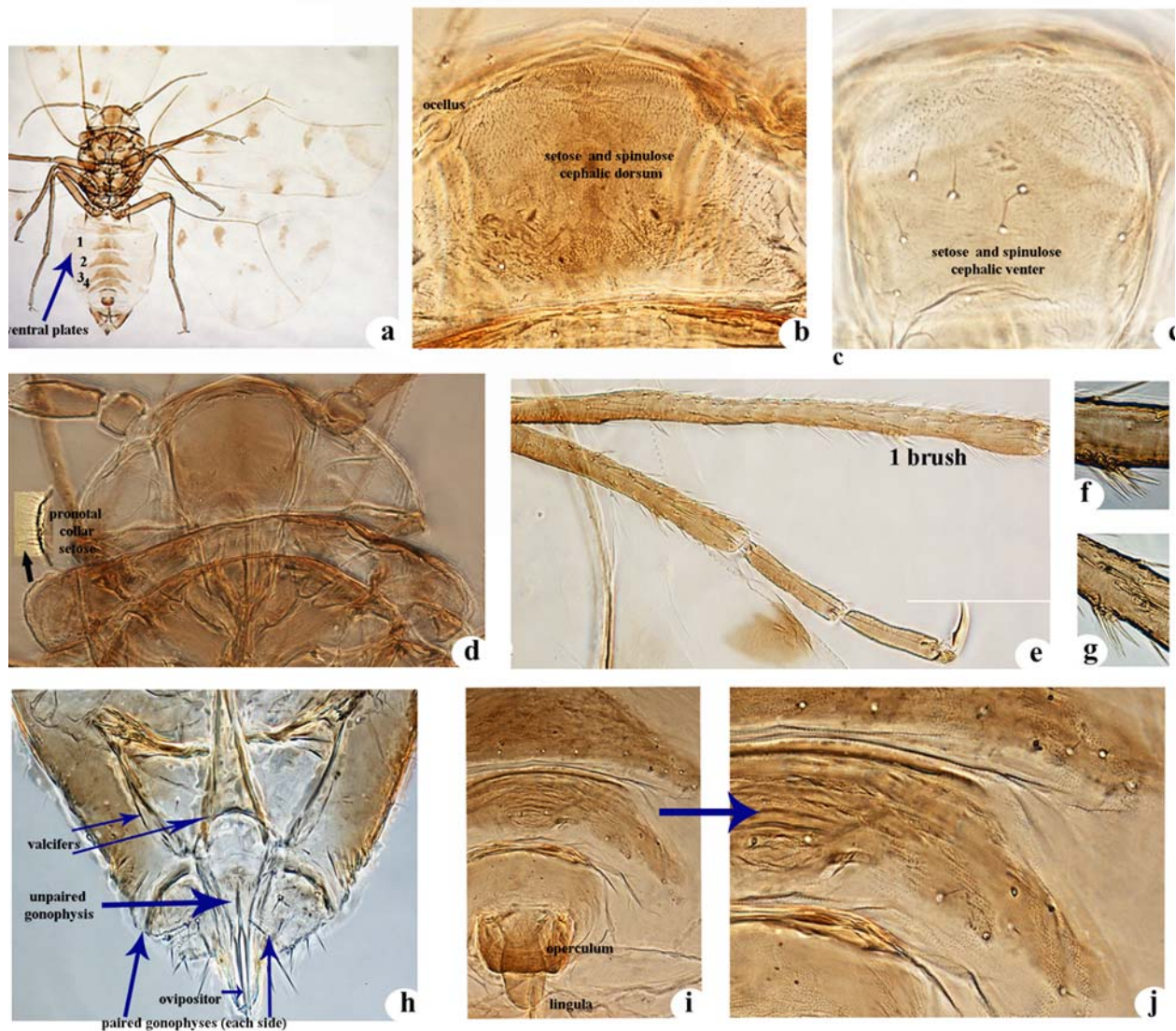
**Figure 15.** *Bakerius hondurensis* (wings). **a)** front wing veins: costa-subcosta, radius, radius 1 and radius 2 (fork), and cubitus; **b)** front wing pair; **c)** and **d)** hind wing pair.



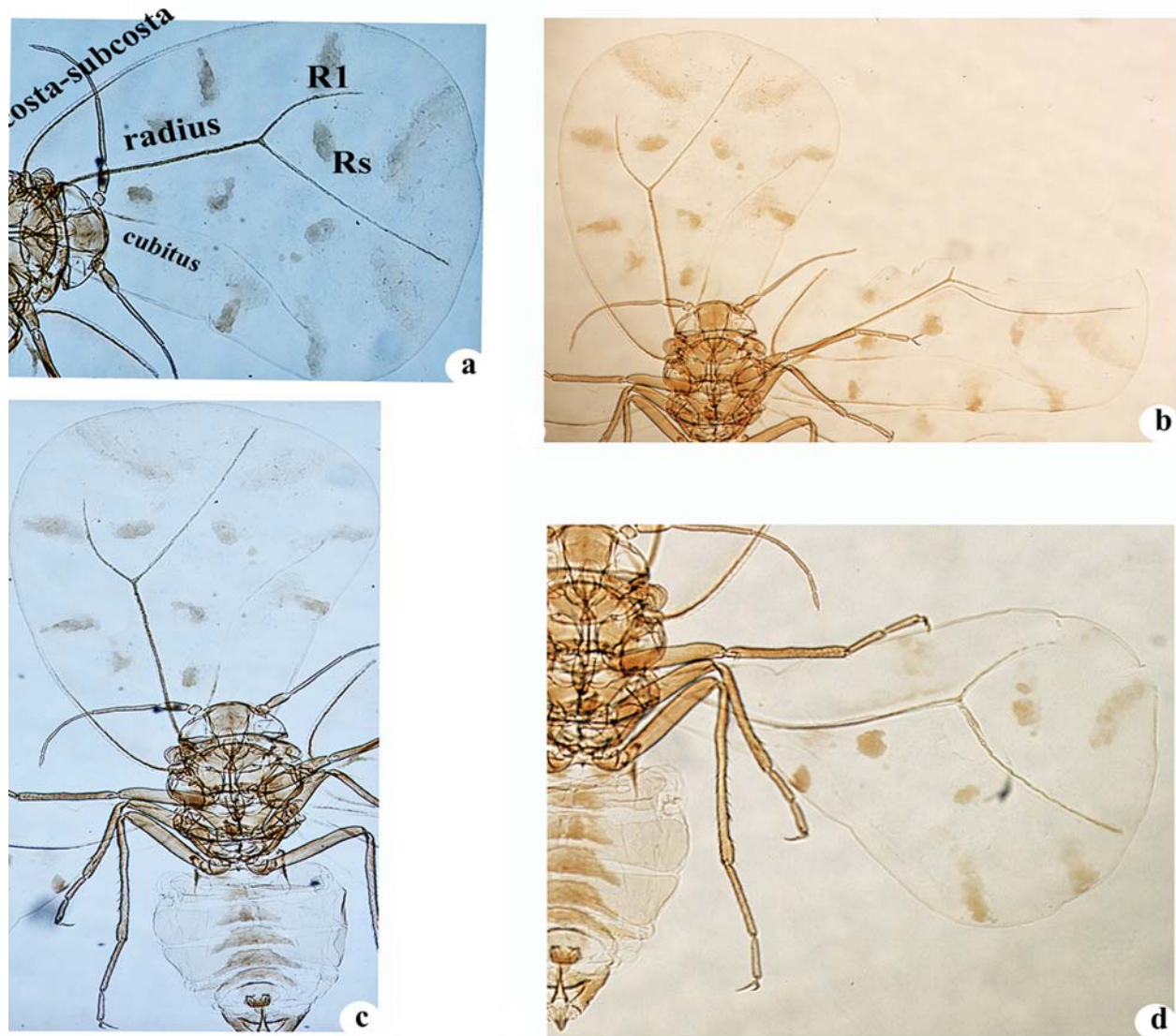


**Figure 16.** *Bakerius leei* (pupa). **a)** pigmented habitus; **b)** AMS, ASMeS(C1 and C2), ASDS, rostrum, and marginal teeth; **c)** AVS (T1 and T2) at base of leg; **d)** margin striated, marginal teeth with forked structure to margin and loculate pore at base; **e)** abdominal compound pores with cone-shaped central process, lengthwise striate central processes, and circled by a ring of loculate and simple disc pores; **f)** CS, PMS, tessellated cuticle; **g)** PSMes(A8), vasiform orifice with operculum and inserted lingua.



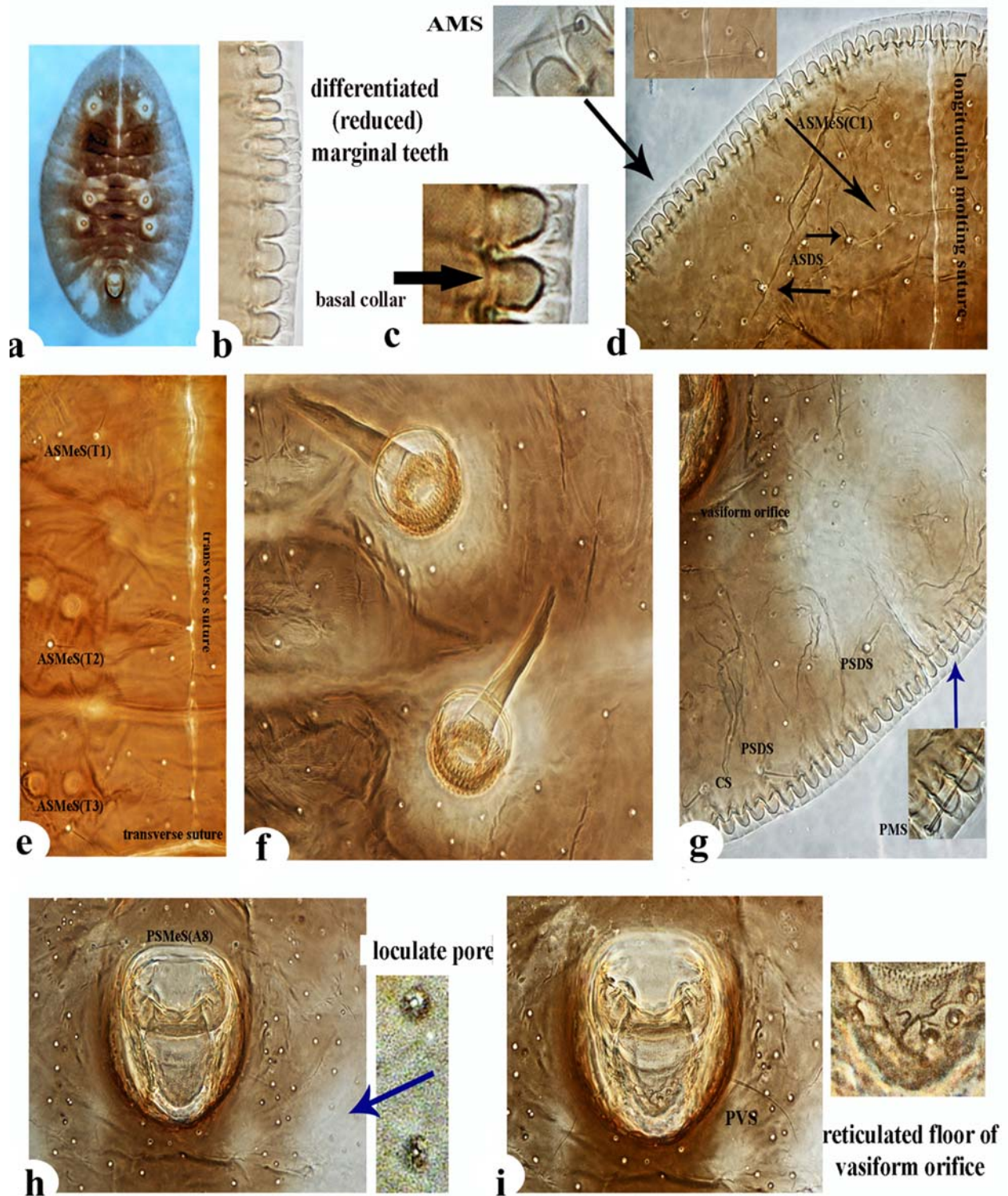


**Figure 17.** *Bakerius peruvianus* (adult female). **a)** habitus showing two pairs of ventral abdominal plates, set of wings, and submedian to median pigmented sternites; **b)** dorsal cephalic setae and spinules; **c)** ventral cephalic setae and spinules; **d)** pronotal “collar” inflated and setose apically; **e)** meso- and metatibia; **f)** one setal brush on metatibia; **g)** two setal brushes on mesotibia; **h)** vasiform orifice with operculum and lingula; gonophyses, ovipositor and valvifers; **i)** pigmented and spinulose abdominal sternite present anterior to vasiform orifice; **j)** enlarged view of pigmented and spinulose abdominal sternite.



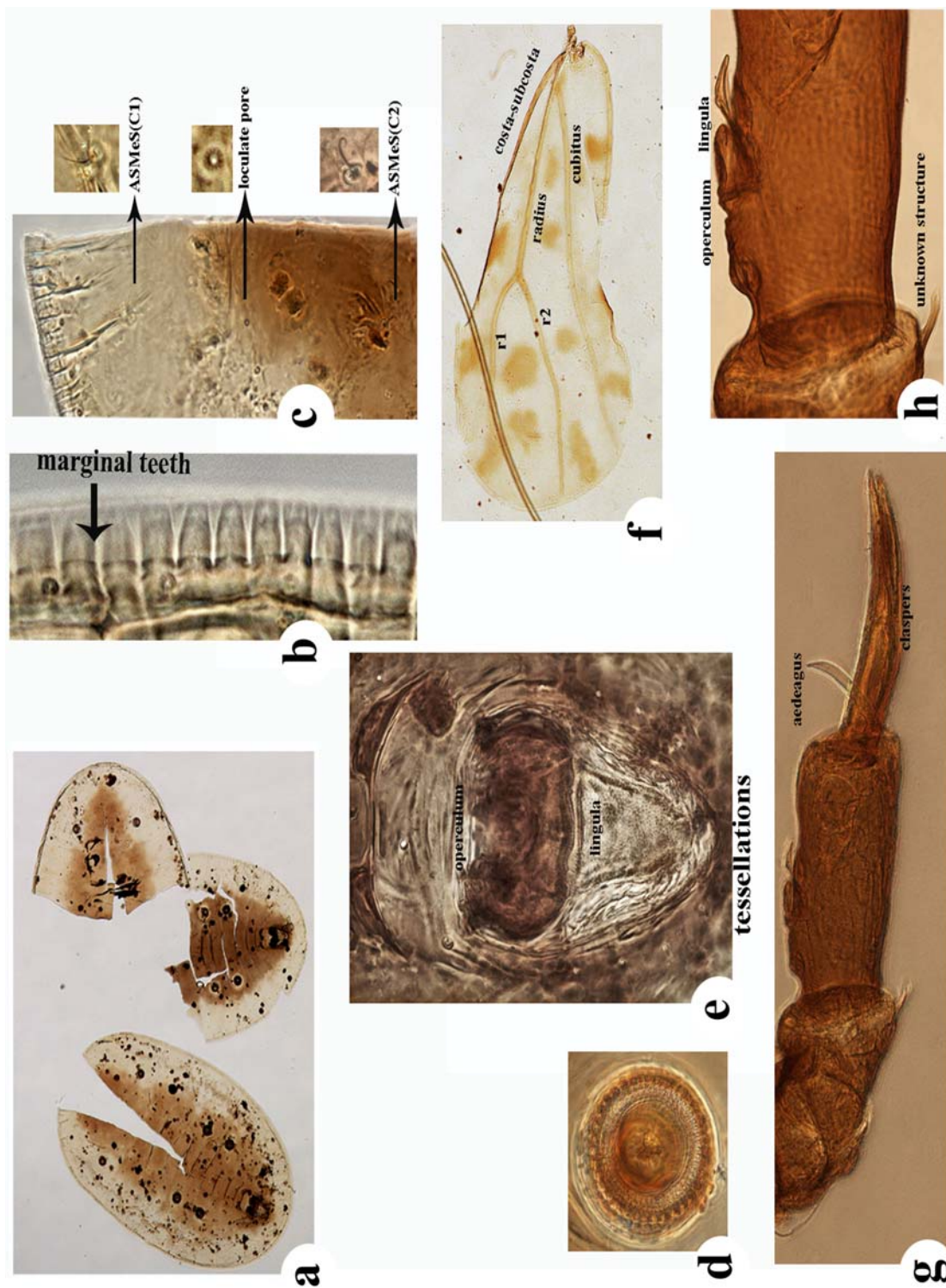
**Figure 18.** *Bakerius peruvianus* (adult female) wings. **a)** wing venation; **b)** fore and hind wings with spotting; **c)** forewing; **d)** hind wing.



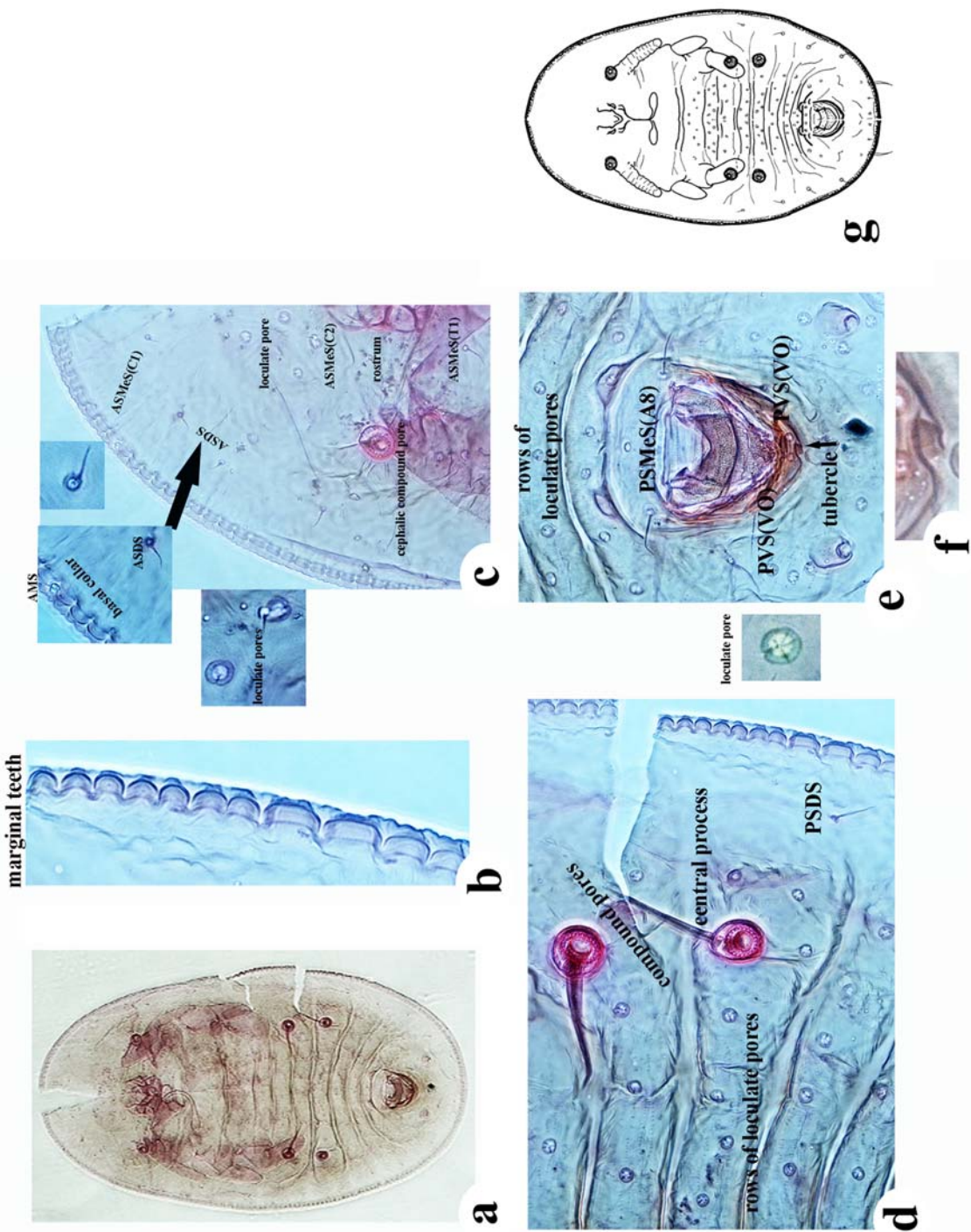


**Figure 19.** *Bakerius peruvianus* (pupa). **a)** pigmented habitus; **b)** thoracic margin and dentate submargin showing 5-6 differentiated teeth; **c)** cephalic compound pore with central process; **d)** AMS, ASDS, ASMeS(C1); **e)** ASMeS(T1, T2, T3), longitudinal and transverse and longitudinal molting sutures; **f)** abdominal compound pores with central process; **g)** CS, PMS, and PSDS; **h)** PSMes(A8), vasiform orifice, operculum and lingula; **i)** PVS(VO).



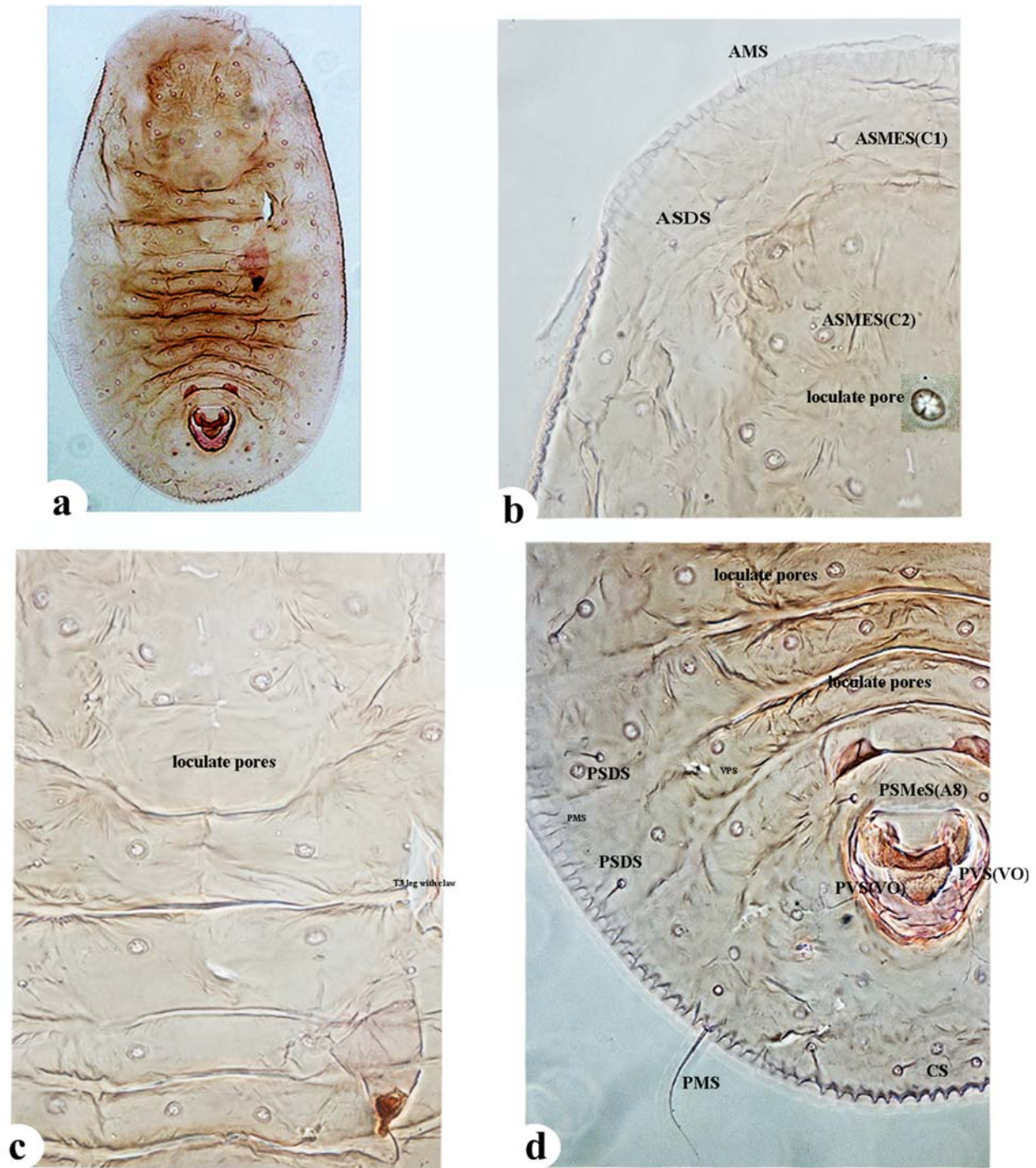


**Figure 20.** *Bakerius phrygilanthi* (pupa and adult male). **a)** pigmented habitus; **b)** marginal teeth with the basal collar; **c)** ASMeS (C1 and C2), loculate pore; **d)** compound pore with central process missing; **e)** vasiiform orifice with operculum and lingula; **f)** wings front wing veins: costa-subcosta, radius 1 and radius 2 (fork), and cubitus; **g)** A8 elongated segment with unknown ventral appendage, dorsal operculum, lingula; claspers and aedeagus; **h)** enlargement of unknown structure.

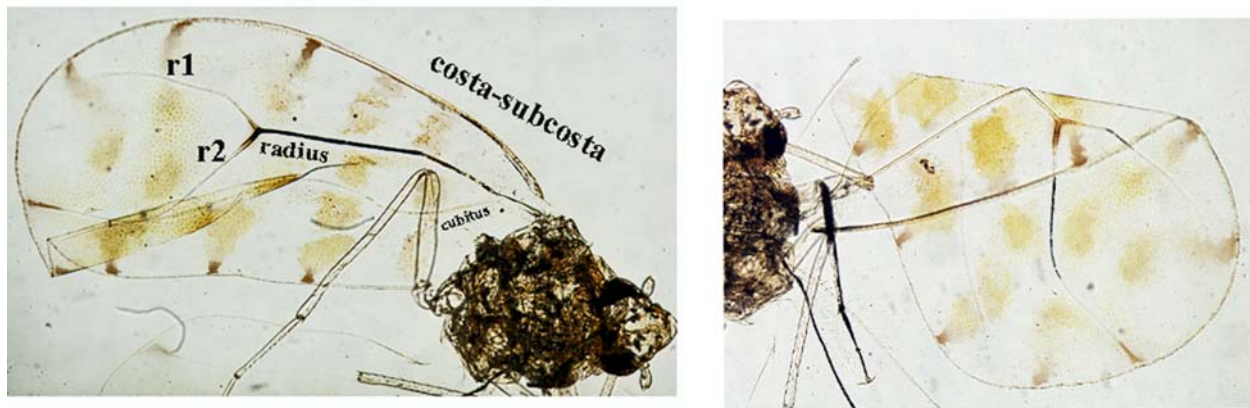


**Figure 21.** *Bakerius sanguineus* (pupa). **a**) pale habitus; **b**) submarginal row of teeth; **c**) cephalic compound pore, loculate pores, rostrum, AMS, ASDS, ASMeS(C1, C2, and T1); **d**) compound pores with central processes, large loculate pores, PSDS; **e**) vasisform orifice, operculum, lingula, posterior tubercle, PSMcS(A8), PVS(VO); **f**) tubercle at the posterior margin of the vasisform orifice; **g**) illustration of habitus showing also the pore distribution.

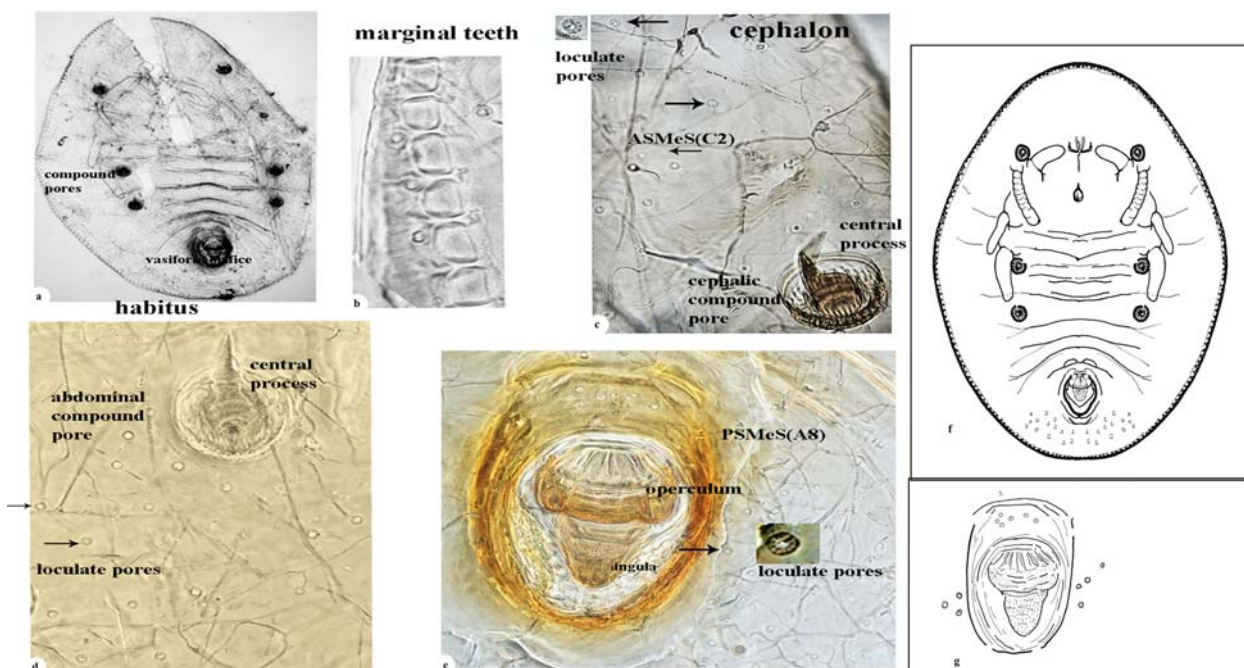




**Figure 22.** *Bakerius sanguineus* (stage 2 nymph). **a)** pale habitus; **b)** large loculate pores, AMS, ASDS, ASMeS(C1 and C2); **c)** loculate pore from cephalon to vasiform orifice; **d)** loculate pores, vasiform orifice with lingula and operculum, CS, PMS, PSDS, PSMeS(A8), PVS(VO) from floor of vasiform orifice.

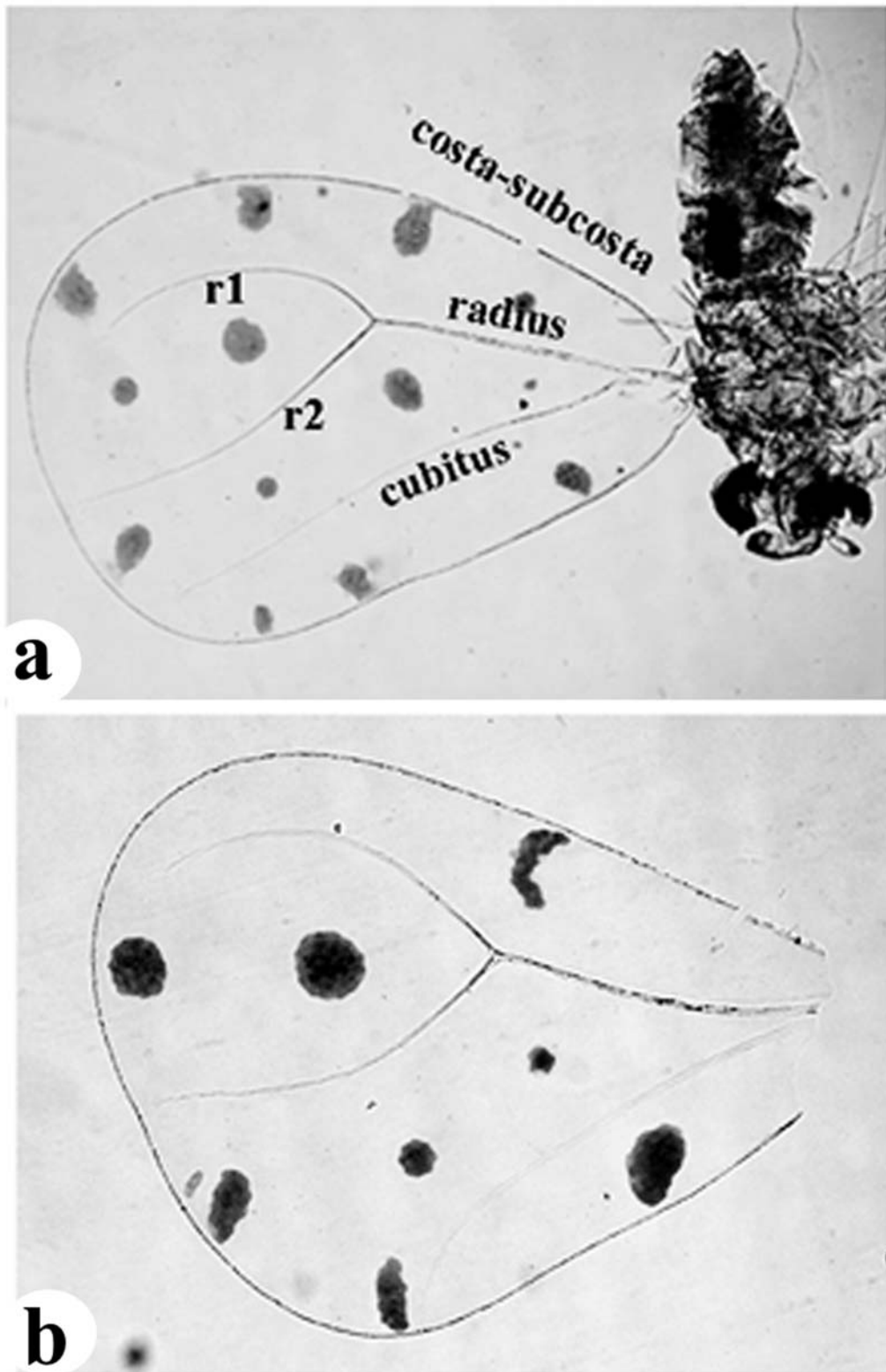


**Figure 23.** *Bakerius sanguineus*: wings and wing venation.



**Figure 24.** *Bakerius sublatus* (pupa). **a)** pale habitus; **b)** marginal teeth; **c)** cephalic compound pore, central process, loculate pore, ASMeS(C2); **d)** abdominal compound pore, central process, loculate pore; **e)** vasiform orifice with operculum and lingula, loculate pores; illustration of, PSMeS(A8); **f)** illustration of habitus; **g)** illustration of vasiform orifice with pore distribution.





**Figure 25.** *Bakerius sublatus*. **a)** habitus and wing venation; **b)** detail of forewing.



**Figure 26.** *Leonardius lahillei* agglomerate pores.



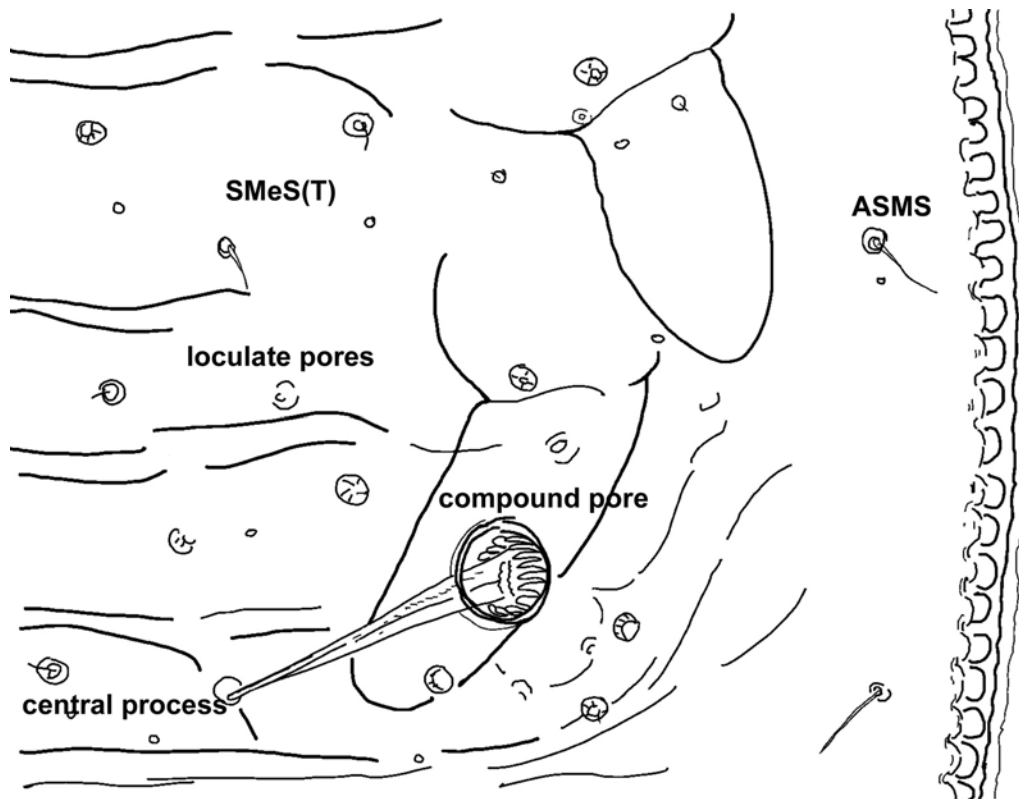


Figure 27. Illustration of loculate pores.



Figure 28. Illustration of submarginal hyaline tubercular structures (sacs).

